JANUARY

25 CENTS

Science and Invention

The City of Tomorrow

In This Issue:

"Casey" Jones

David Belasco

William Dubilier

Walter P. Chrysler

148 PAGES of outstanding RADIO VALUES

On every page of this big catalog for 1930 you will find radio merchandise of unusual interest—priced at the lowest wholesale quotations. No radio enthusiast or dealer can afford to be without it.

The latest radio devices and improvements are illustrated—sets, accessories, parts and kits—at price-saving reductions that spell the buyer's opportunity. Astounding offerings in new, humless, Screen Grid A. C. all-electric and battery operated sets; beautiful and artistic consoles; dynamic speakers of great volume and rich tone; and everything considered standard in accessories, parts and kits.

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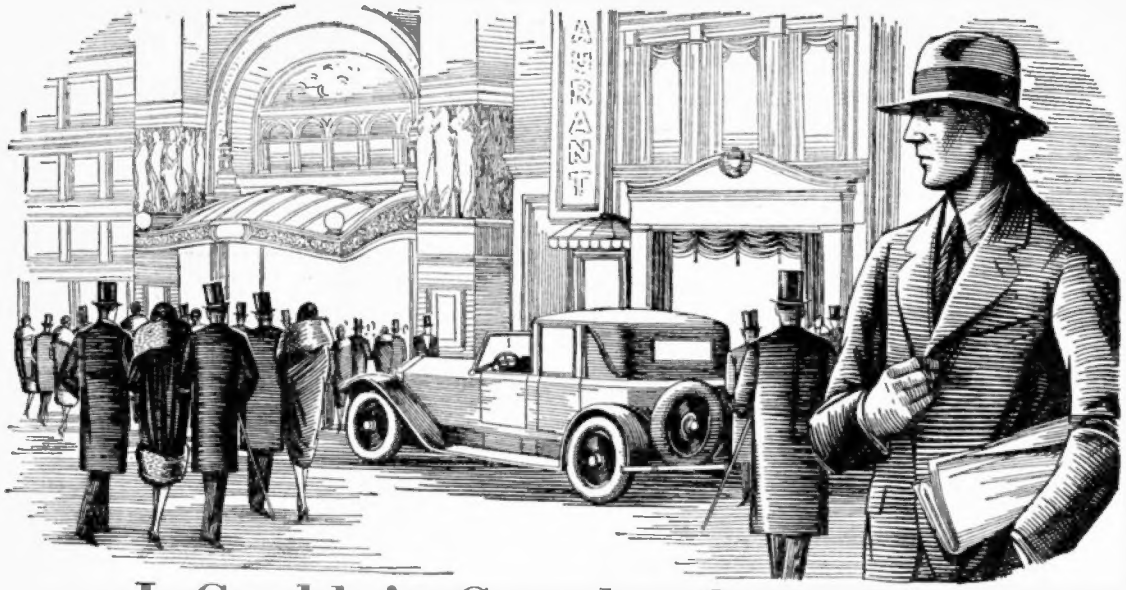

Always outside of things—that's where I was just twelve short months ago. I just didn't have the cash, that was all. No theatres, no parties, no good restaurants. No real enjoyment of life. I was just getting by, just existing. What a difference today! I drive my own car, have a good bank account, enjoy all the amusements I please.

I Couldn't Get the Good Things of Life

Then I Quit My Job and "Found" Myself!

HOW does a man go about making more money? If I asked myself that question once, I asked it a hundred times!

I know the answer now—you bet. I know the way good money is made, and I'm making it. Gone forever are the days of cheap shoes, cheap clothes, walking home to save carfare, pinching pennies to make my salary last from one pay-day to the next one. I own one of the finest Radio stores you ever saw, and I get almost all the Radio service and repair work in town. The other Radio dealers send their hard jobs to me, so you can see how I stand in my line.

But—it's just a year ago that I was a poorly paid clerk. I was struggling along on a starvation salary until by accident my eyes were opened and I saw just what was the matter with me. Here's the story of just how it happened.

One of the big moments of my life had come. I had just popped the fatal question, and Louise said, "Yes!"

Louise wanted to go in and tell her father about it right away, so we did. He sort of grunted when we told him the news, and asked Louise to leave us alone. And, my heart began to sink as I looked at his face.

"So you and Louise have decided to get married," he said to me when we were alone. "Well, Bill, just listen to me. I've watched you often here at the house with Louise and I think you are a pretty good, upstanding young fellow. I knew your father and mother, and you've always had a good reputation here, too. But just let me ask you just one question—how much do you make?"

"Twenty-eight a week," I told him.

He didn't say a word—just wrote it down on a piece of paper.

"Have you any prospects of a better job or a good raise some time soon?" he asked.

"No, sir; I can't honestly say that I have," I admitted. "I'm looking for something better all the time, though."

"Looking, eh? How do you go about it?"

Well, that question stopped me.

How did I? I was willing to take a better job if I saw the chance all right, but I certainly had laid no plans to make such a job for myself. When he saw my confusion he grunted. "I thought so," he said. Then he held up some figures he'd been scribbling at.

"I've just been figuring out your family budget, Bill, for a salary of twenty-eight a week. I've figured it several ways, so you can take your pick of the one you like best. Here's Budget No. 1: I figure you can afford a very small unfurnished apartment, make your payments on enough plain, inexpensive furniture to fix such an apartment up, pay your electricity, gas and water bills, buy just about one modest outfit of clothes for both of you once each year, and save three dollars a week for sickness, insurance, and emergencies. But you can't eat. And you'll have to go without amusements until you can get a good, substantial raise in salary."

I began to turn red as fire.

"That budget isn't so good after all," he said, glancing at me; "maybe Budget No. 2 will sound better——"

"That's enough, Mr. Sullivan," I said. "Have a heart. I can see things pretty clearly now; things I was kidding myself about before. Let me go home and think this over." And home I went, my mind in a whirl.

At home I turned the problem over and over in my mind. I'd popped the question at Louise on impulse without thinking it out. Everything Mr. Sullivan had said was gospel truth. I couldn't see anything to do, any way to turn. But I had to have more money.

I began to thumb the pages of a magazine which was lying on the table beside me. Suddenly an advertisement seemed almost to leap out at my eyes, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

What's happened in the twelve months since that day seems almost like a dream to me now. For ten of those twelve months I've had a Radio business of my own! At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the institution that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business, such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing, "I never had a chance!"

Now I'm making real money. Louise and I have been married six months, and there wasn't any kidding about budgets by Mr. Sullivan when we stepped off, either. I'll bet that today I make more money than the old boy himself.

Here's a real tip. You may not be as bad off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be doing something about it instead of drifting.

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—no matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. OAS, Washington, D. C.

J. E. SMITH, President,
National Radio Institute,
Dept. OAS, Washington, D. C.

Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

Name .....

Address .....

Town .....State .....

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450 Miles to the Gallon!
By Alfred M. Caddell

A New Solution of Our Traffic Problem

Which Shall It Be—Dirigible or Airplane?
By Augustus Post

Gliders—Another Article for the Embryo Fliers

When "Ching Ling Foo" Got Fooled
By "Dunninger"

Pumping Mud to Make Airports

WITH OUR AUTHORS

AUGUSTUS POST, author of the article in the present issue "What I Found On Board The R-101," is known practically all over the world and he has associated so many years with the leading aeronautical people, that the name of Post is practically a household word. Mr. Post predicted in 1914 Colonel Lindbergh's flight from New York to Paris. He also drew up the rules for the prize won by Colonel Lindbergh and offered by Mr. Raymond Orteig. Mr. Post has written numerous aviation articles and is a popular lecturer on aviation.

DR. DONALD H. MENZEL, of the famous Lick Observatory staff, has been writing astronomical and physics articles for a number of years, and he is one of the foremost of the younger generation of astronomers in this country. Dr. Menzel was previously connected with the Harvard Astronomical Observatory, and has made a special study of the Einstein theory. Several of his articles have appeared in this magazine in the past few months dealing with a popular interpretation of some of the Einstein arguments.

HARRY F. TAPP, author of the articles on Oil Burners for Home Furnaces, which are now appearing in this journal, is one of the best experts on oil burners that we have today. Mr. Tapp is a college bred man and has made a specialized study of oil burners, with the result that he stands today at the top of his profession in that particular field, and is the technologist or consulting engineer to the American Oil Burner Association. He is the author of the "Handbook of Domestic Oil Heating."

GEORGE A. LUERS, who edits the Motor Hints section every month, is a consulting engineer of Washington, D. C., and has done considerable engineering work connected with the Arsenal at Washington.

DON BENNETT, who writes so interestingly every month on Home Movies, has had considerable experience in the motion picture field. As in many of other branches of industrial activity, he comes into the home movie realm with a background of extensive experience gained in the regular theatrical motion picture field, including every detail of the business.

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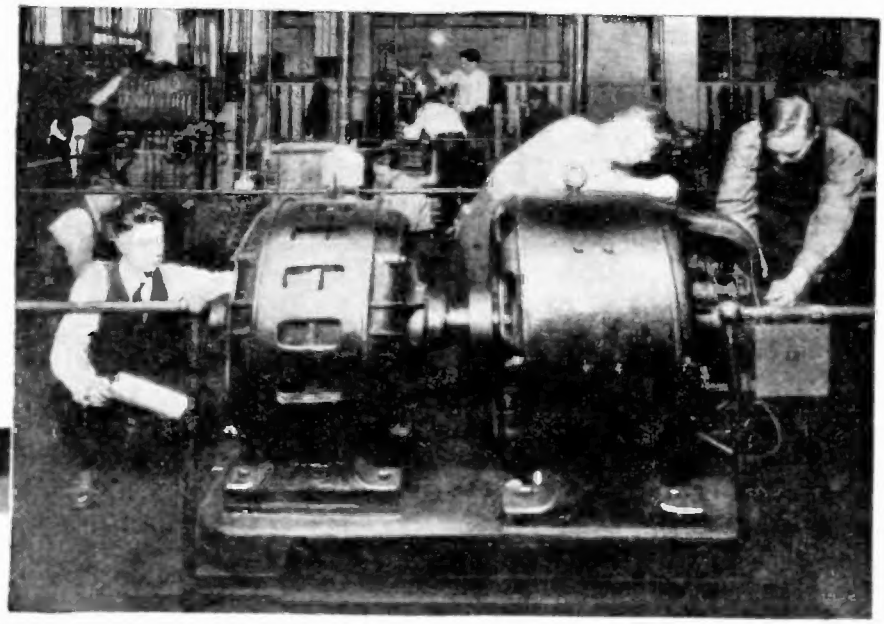
The Old Way



ELECTRICITY Becomes Amazingly Easy When Taught Without Books or Lessons IN 90 DAYS

Why work at dull, uninteresting jobs that will never pay you more than *$35*, *$40* or perhaps *$50* a week? Make up your mind NOW and become a master of electricity! Train in 12 easy weeks to hold down the kind of a job that pays $60 and up a week, and which creates a constant demand for your services nearly any place in the world!

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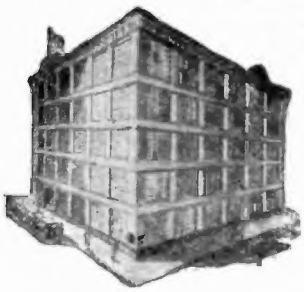

This is our new, fireproof, modern home wherein is installed thousands of dollars' worth of the newest and most modern Electrical Equipment of all kinds. We have now the largest amount of floor space devoted to the exclusive teaching of practical electricity in the world. Every comfort and convenience has been arranged to make you happy and contented during your training.

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COYNE ELECTRICAL SCHOOL, Dept. 10-27
500 S. Paulina Street, Chicago, Ill.

Please send me your free catalog on Electricity and details of your railroad fare allowance and extra courses. No obligation on my part.

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Holding Down the R101

IT takes quite a weight to hold down this mighty monarch of the skies. A mooring mast and four of these massive rollers, each one weighing a ton, are barely sufficient to keep the gigantic dirigible from roaming over the British Empire. The one-ton roller shown swings from the tail end of the R-101 as the huge airship is moored to the mast at Cardington, England.

Who else wants a good

DRAFTING JOB ?

NOW— jobs for students!

We have recently developed a remarkable placement service which enables us to find good positions for our students when only half way through the course. These men are making RAPID progress because they are combining spare time study with experience on the job—and that's a combination that can't be beat! Mail the coupon, and we'll tell you all about this new job-finding plan.

DURING the past few months we have placed HUNDREDS of former mechanics, clerks and even beginners in fine positions—with Contractors, Architects and in big manufacturing plants all over America (read a few typical letters below).

These men came to us because they were dissatisfied with their earnings and with their future prospects. Now they are doing work they like—making good money—*and have a real chance to advance still farther.*

If you are trying to solve a similar personal problem, we invite you to get in touch with us. We'll be glad to show you how you, too, can get a well-paid Drafting job without risking a penny of your money.

Electrical Jobs

An easy way to break into the great, prosperous, well-paid Electrical industry, is to learn Electrical Drafting. Then the doors of opportunity in a line where the "Sky's the limit" are open to you.

Building and Construction Jobs

Many of our students specialize in Architectural or Structural Drafting, and then we help them get good jobs with Contractors or Architects. A knowledge of Drafting is a pass-port to quick success in the big building industries.

Automotive Jobs

Look through the want-ads of any city where there are automobile factories and you'll be surprised at the number of Draftsmen required, and the splendid salaries paid. Many noted automotive engineers and executives got into the work through Drafting.

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Any experience you have in mechanical lines will be of priceless benefit to you as a Draftsman, *for then you know how things are done on the job.* Drafting is PROMOTION for the mechanic and apprentice.

Wonderful Opportunities Open to DRAFTSMEN!

Pick up the want ads of any big city newspaper and you'll see why we advise men to go into Drafting. 70,000 fine positions were advertised in the past year by Architects, Contractors, and in Electrical, Mechanical and Automotive lines.

The ability to read blue-prints and draw plans is the entering wedge to success in all building and manufacturing industries. The work is mighty interesting and pleasant, the hours are easy, and Draftsmen are a wonderful bunch of fellows to work with. Best of all, Drafting offers you the chance to meet BIG MEN, the chance to take charge of big jobs, the kind of future you've always hoped for.

Promotion for Office and Factory Workers . . . .

Thousands of men—not a bit smarter than you, with no more schooling or experience—have gone from poorly paid positions as clerks, mechanics, salesmen, building-trades workers, laborers and beginners—into Drafting positions paying $40, $50 and up to $100 a week, with our help.

I want to show you that a good Drafting job is now easily within your reach. And I want to set before you our amazing plan of home-training and placement which we have worked out with the cooperation of some of the biggest employers and engineers in America.

Great Chance for YOU if You Act QUICK!

Right now we have an interesting proposition for ambitious men eager to get into Drafting. It will pay you to rush the coupon to us by first mail.

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Starts at $40 a Week

"Thanks for helping me get a Drafting position with Slyker Co. starting at $40 a week."

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"I have landed a job with the Pacific Tel. and Tel. Co. in Seattle, and I must say that I am greatly indebted to the American School for my success. You have done all that you promised in helping me obtain employment."

T. C. White

Now Junior Draftsman

"I have obtained a position as a junior draftsman with the Muncie Oil Engine Co. I appreciate your aid in obtaining this position very much."

M. N. Barehan, Muncie, Ind.

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Please tell me, without cost or obligation, about your training and employment service in line marked X below.

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☐ Structural Steel	☐ Mechanical Engineering
☐ Civil Engineering	☐ Shop Superintendent
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☐ Electricity	☐ High School in 2 years

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St. No._____

City_____ State_____

Age_____ Occupation_____

A RADICAL NEW DEVELOPMENT IN PUBLISHING NOW BRINGS YOU THE BEST NEW DETECTIVE NOVELS COMPLETE FOR 25¢....

"Young Peter's been shot in his room. They had to break the door down to get in to him. He was dead when they got there."

The VAN NORTON MURDERS

THERE have been so many detective novels published in the past few years that to find one both exceedingly well written and startlingly different is a distinct surprise.

"The Van Norton Murders," by Charles Reed Jones, combines both these qualities in a swift-moving and refreshing pace. The author, you may recall, also wrote "The King Murder," Dutton's Book of the Month for April, which called forth columns of praise from the nation's critics, because of its novel reasoning and unusual plot development.

In "The Van Norton Murders" the plot evolves around a wealthy Long Island family which is rapidly being killed off in spite of all the police can do. It seems evident that it isn't an outside job, yet no trace of suspicion can be pinned on anyone in the whole household.

One of the detectives in the story, however, tells you that he knows the murderer, and that you can figure it all out yourself if you have read the story carefully up to this point (and you actually can). You'll probably find that from the moment you turn the first page you will be so completely enveloped in the problem before you that the wee early hours of the morning will still find you gripping the arms of your chair in tensed fascination.

"I know damn well he didn't shoot himself, because I never heard of a guy shooting himself in the back, but the door was locked."

AND THE COMPLETE PRICE IS ACTUALLY ONLY 25c

Moreover, the publishers have gone and brought the novel within reach of everybody by enabling you to buy it complete for only 25c at all newsstands. Simply ask your newsdealer for the January Complete Detective Novel. (There will be a new one at your newsstand every month.) If he is already sold out, send 25c in stamps or coin to

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4 of the 40 Easy Ways to Make $3.00 an Hour In Your Spare Time in RADIO

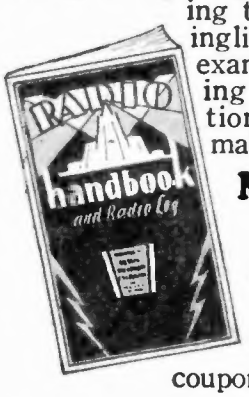
THE four plans shown are but a sample of the many ways in which our members are making $3.00 an hour upwards, spare time and full time, *from the day they join the Association.* If you want to get into Radio, have a business of your own, make $50 to $75 weekly in your spare time, investigate the opportunities offered the inexperienced, ambitious man by the Association.

REDUCE STATIC BY MARVELOUS METHOD
WIRE EVERY ROOM FOR RADIO RECEPTION
IMPROVE TONE AND VOLUME OF OLD SETS
RADIO-FY & ELECTRIFY PHONOGRAPHS

Our Members Earning Thousands of Dollars Every Week

The Association assists men to cash in on Radio. It makes past experience unnecessary. As a member of the Association you are trained in a quick, easy, practical way to install, service, repair, build and rebuild sets—given sure-fire money-making plans developed by us—helped to secure a position by our Employment Department. You earn while you learn, while you prepare yourself for a big-pay Radio position.

The Association will enable you to buy parts at wholesale, start in business without capital, help you get your share of the $600,000,000 spent annually for Radio. As a result of the Association, men all over the country are opening stores, increasing their pay, passing licensed operator examinations, landing big-pay positions with Radio makers.



Mail Coupon Today for the FREE HANDBOOK

It is not only chock-full of absorbing information about Radio, but it shows you how easily you can increase your income in your spare time. Mailing the coupon can mean $50 to $75 a week more for you.

Radio Training Association of America
4513 Ravenswood Avenue Dept. RN-1, Chicago, Illinois

Below are a few of the reports from those now cashing in on the "40 Easy Ways"

Clears $3,000.00 Frank J. Deutch, Pa.—"Since joining the Association I have cleared nearly $3,000.00. It is almost impossible for a young fellow to fail, no matter how little education he has, if he will follow your easy ways of making money."

$1,100.00 in 6 Weeks J. R. Allen, Calif. — "Have done over $1,100.00 worth of business in the last 6 weeks. Next month I am going to open up a store of my own. I never knew that money could come so fast and easy."

$25.00 a Week Spare Time N. J. Friedrich, N. Y.—"I have averaged $25.00 a week for the last 7 months even though I am not a graduate but just learning."

Training Lands Him Job R. C. Kirk, N. C.—"Your training has been very valuable to me. I landed a job with the big department store out here a few weeks ago because I had my membership card with me. There were a large bunch of applications ahead of me."

ACT NOW
If You Wish NO-COST Membership

For a limited time we will give to the ambitious man a No-Cost Membership which need not—should not—cost you a cent. For the sake of making more money now, and having a better position in the future, mail coupon below *now.* You'll always be glad you did.

Radio Training Association of America
Dept. RN-1, 4513 Ravenswood Ave., Chicago, Ill.

Gentlemen: Please send me by return mail full details of your Special No-Cost Membership Plan, and also a copy of your Radio Handbook.

Name .....

Address .....

City ..... *State* .....

JANUARY, 1930
NUMBER 9

Science and Invention

VOLUME XVII
WHOLE NO. 201

Arthur H. Lynch, Editorial Director

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Financial Editor

AUGUSTUS POST
Aviation Editor

WILLIAM F. CROSBY
Marine Editor

Editorial

. . . THE PRACTICABILITY OF LARGE DIRIGIBLES. There are two schools of thought in the aircraft field in the matter of volume transportation. Many of the greatest students of aerodynamics are very firmly convinced that the airship of the future must be of the lighter-than-air class. The making of lighter-than-air craft of extremely large size presupposes the use of interior supporting members. This is very well illustrated in such dirigibles as the R-101, which is fully described in this number of SCIENCE AND INVENTION.

The other school of thought is firmly convinced that the airship of the future capable of carrying the greatest pay load economically will be some development of the airplane. The possibilities of the heavier-than-air craft were brought home very vividly when the DO-X, representing the largest 'plane built to date, recently took to the air with 169 passengers and crew. This flight, of course, was only for an hour's duration and consequently not much of the weight taken into the air was represented by fuel. On the other hand, it is to be noted that the Graf Zeppelin, powered by 2,550 horsepower, as against 6,000 for the DO-X, has a useful load capacity of 140,000 pounds. Translated into the number of human beings this ship is capable of lifting, figured on the basis of 150 pounds per person, the dirigible could take approximately 933 people aloft. To date, the greatest number of people ever transported in a dirigible is 82, but the distance covered, which involves many tons of fuel, has been thousands of miles.

Factors of speed, ground facilities and so forth must also be reckoned in the heavier as against the lighter-than-air analysis. With the cruising speed of the DO-X approximately double that of the present-day dirigible and with considerably less hangar space and ground crew necessary the plane type of craft possesses many attractive advantages.

However, the entire subject is well worth thorough investigation and the superdirigible now being built by the United States Navy and the superhangar which is already under way to house it are introducing engineering problems which but a few years ago would have appeared to be completely insoluble. An interested world watches this competition.

* * *

. . . RADIO FOR YOUR CAR. Our contemporary, *Radio News*, is sponsoring a campaign to popularize the use of radio receivers in automobiles. The idea is being received with acclaim generally, but there are some who believe that we already have enough noise and that the use of radio receivers may also increase the traffic hazard. In some of our more congested areas there may be some justification for this idea, but for the most part we believe that rather long trips across country will be much more comfortable when accompanied by music to suit our mood. This extremely interesting field opens up many new lines of development and offers those interested in radio technique an opportunity to investigate electrical fields again in somewhat the same fashion that the public took generally to the introduction of the regular broadcast receiver. It is very likely that the home constructor will have another very interesting day.

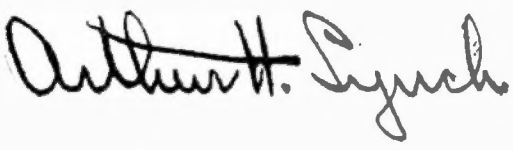
* * *

. . . CITIES OF TOMORROW. Our cities are becoming too congested. The congestion is rapidly reducing the efficiency of trade which fosters the grouping of business interests. Cities of the future will, for a few years, at least, get much of their architecture from such men as Le Corbusier, whose interesting article appears in this number. Suppose, and it is easy to suppose, that we find that it becomes so difficult to get around town by auto that it becomes necessary to pull down all our present buildings and have beautiful cities of tall buildings and green fields. Airplanes flitting in and out among the skyscrapers are bound to be an ordinary part of urban life twenty years from now.

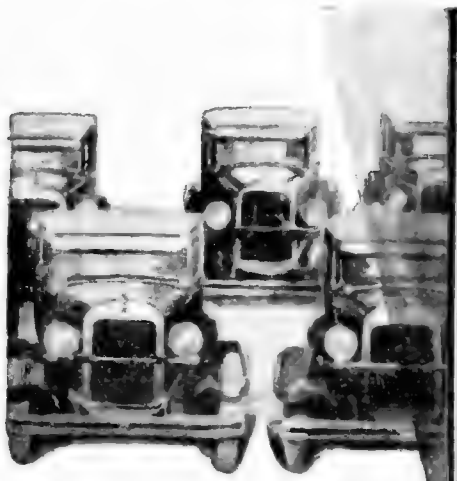
. . . SUPPOSE—There is just one fly in the ointment. Suppose a plane or two, heavily laden with bombs, come dropping them at the base of a few buildings. General William Mitchell says an army and a navy are useless against such an attack.

* * *

. . . MUSIC FOR THE MASSES. There is no more refining influence than the influence of music and poetry. Scientific efforts are now being made to provide music of the highest order in our theatres, schools and even in our homes. Some delay in the progress has been caused by groups of musicians who feel that the radio, the talking movies, and other similar mechanical devices will do them out of a livelihood. We feel that this is a short-sighted view to take, and believe that when America becomes completely music-wise, there will be a broader rather than a narrower opportunity for the truly good musician. Much development work still remains to be done before the mechanical reproducers of music reach perfection, but improvement is so rapid that a "talkie" in any of our country towns is superior to one of the old road shows.



"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - HUXLEY



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1 Every used car is conspicuously marked with its lowest price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.

2 All Studebaker automobiles which are sold as CERTIFIED CARS have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.

3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

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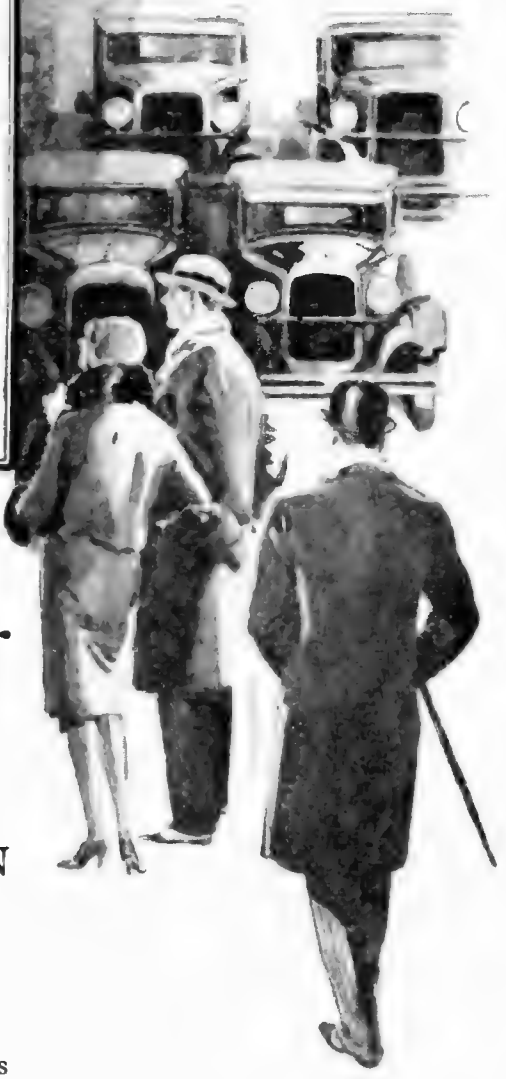

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A WELL constructed car, sold at 40 or 50 per cent of its original price, offers maximum transportation value. Studebaker dealers offer many fine used cars—Studebakers, Erskines and other makes—which have been driven only a few thousand miles. ¶ Reconditioning of mechanical parts, refinishing of bodies give new car life to these cars at prices no greater than you must pay for a cheap new car. And as a final measure of protection, these cars are sold according to the Studebaker Pledge—which offers 5 days' driving trial on all cars and a 30-day guarantee on all certified cars. ¶ Prices being plainly marked provides the same price for everyone. Millions of people buy "used" houses. Every car on the road is a used car the week after it is purchased.

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What Famous Men

A Symposium of Opinions

Walter P. Chrysler, well-known motor car manufacturer and one of the outstanding geniuses in automobile design.

Walter P. Chrysler Predicts Many Improvements in Cars

GREATER flexibility, longer life, superior performance and increased quietness will be among the major improvements on automobiles for the coming season.

Greater flexibility will be achieved very largely through the use of the multi-speed gearbox, putting an extra speed in the hands of the driver when he needs it. The use of four instead of three speeds will enable the experienced driver to get more out of his car than is possible with three speeds, because he will be able to accelerate up-hill, travel faster on the level roads and in every way be prepared to meet existing road and grade conditions with a gear

Motor cars will show greater flexibility, longer life, superior performance and increased quietness.—*Chrysler.*

ratio that is ideally suited for those conditions. For this same reason, proper driving will be made immeasurably easier for the inexperienced driver.

Better carburetion, largely secured through the down-draft method, will increase flexibility still further by always placing at the disposal of the motorist sufficient fuel, properly mixed, to meet the demands of the driver's foot on the accelerator pedal. Backed up by fuel pump feed instead of vacuum, with the mixture flowing downward with gravity instead of against it, the motor will be responsive, regardless of the condition of the vacuum in the manifold. This is a real improvement.

Longer life will be secured through the elimination of vi-

(*See continuations on page* 841)

© Blank & Stoller

Harvey Wiley Corbett, well-known architect and designer of skyscrapers.

Harvey Wiley Corbett, Famous American Architect, Looks Ahead

THE probable advance in architecture in 1930 that would be of interest to readers of *Science and Invention* will be an increasing development in the use of skyscraper buildings for business, hotel and apartment purposes, considerably in advance of what has been in the past. The present generation is air-minded and buildings will follow that trend.

In the matter of architectural styles, it is well to note that archæological styles so consistently used during the last thirty years, are very rapidly disappearing. Both architects and their clients see little reason why an individual in this rapidly moving twentieth century should be housed, either in his home or office, in a setting inspired by the Middle Ages and the Renaissance.

Buildings will be built with a fastening together of parts previously manufactured in the factory.—*Corbett.*

New methods of construction will undoubtedly come into general use—methods more consistent with machine production. Buildings, in my opinion, will

(*Continued*)

I look for further refinements in the synchronization of light, movement and sound in the theatre—*Belasco.*

Photo by J. E. Abbe

David Belasco, Dean of the American Theatrical Producers and Master of Mechanical Stagecraft.

David Belasco Discusses Stage Mechanisms

INVENTIONS for the theatre invariably come through necessity. Often they meet emergencies. A need arises and someone improvises something which will care for it. If it works, then that is made the basis for the next inventive step. Consequently it is difficult to predict what 1930 will bring us in stage invention.

Personally, I can promise some new lighting effects, based on my other inventions of the last fifty years—but again they will be effects demanded by the atmosphere of new plays; again they will be an improvisation to meet a sudden requirement.

Stage mechanism has reached nearly its peak of perfection. Lights, too, are standardized, largely through inventions in my own experimental laboratory. There has been developed the light I have sought all of my life—reflected, diffused and capable of carrying color—a light without center of illumination and equal in intensity throughout its area.

Even my electrical technician, Mr. Hartmann, and I do not know as yet what developments may grow from this, except to be assured that when the need arises we will find new methods of using the light, or some new method of directing it. I look for further refinements in the synchronization of light, movement and sound during the year 1930, but nothing in addition seems indicated for the speaking stage.

Dr. Ales Hrdlicka Sees Advances in Evolution

THE probable progress in our knowledge of human evolution, and of evolution in nature in general, during 1930, will be, it may be anticipated, essentially that of a gradual

© Bachrach

Dr. Ales Hrdlicka, U. S. National Museum, Washington, D. C., prominent exponent of human evolution.

further crystallization of ideas in this field, together with the accretion of additional detailed facts, bearing on the subject and brought out through experimental and other studies.

There is always the possibility of startling, highly important discoveries of new material in the line of man, the other primates, or the rest of the organic realm, but judging by the past it is more probable that there will be but moderately important finds which, nevertheless, individually or on the whole, will not fail to add to the solid paving of which the basis of the science of evolution is being constructed. The most hopeful localities for discoveries in the human line, and in that of the anthropoid ancestry, will be western and southern Europe, Palestine and Asia Minor in general, and Africa.

In writings there will probably continue a development in the Lamarckian rather than DeVriesian direction.

Predict for Science in 1930

of Leaders in Art, Science and Industry

Radio Advances Envisioned by William Dubilier

THERE will be no great changes during the year 1930, for the industry has been taught that a great change will do more harm than good. Improvements and developments will continue, however, with the public getting the benefit of greater value for money spent.

Radio sets will be sold in combination with talking moving pictures for the home. —*Dubilier.*

Regarding radio sets, these will be simplified, a smaller number of tubes will be used to give the volume required. Ra-

William Dubilier, radio pioneer and inventor of apparatus bearing his name.

dio sets will be sold in combination with talking moving pictures for the home, as the radio equipment is not only capable of supplying entertainment received from broadcasting stations, but is adaptable for supplying the sound for moving pictures. The large proportion of the sets for next year will have provisions for phonograph reproduction and for home movies, at a cost within the reach of the masses. With screen-grid tubes and simplified components, four or five vacuum

(*Continued*)

The Pacific will be crossed in the air without a stop and the world circumnavigated by refueled flight.—*Post.*

Augustus Post Sees New Thrill in Dirigible Races

THE immediate future will see 100-ton air liners and air lines and routes of commercial transport planes greatly extended, connecting the one thousand projected airports in all parts of this country with those in all quarters of the globe. While speed is the first great factor in air travel, luxury, comfort, safety and freedom from dust and dirt are equally important. Unsightly, crowded conditions on monotonous earthly routes must give way to the broad, inspiring bird's-eye view that makes air travel such a joy.

Mechanical landing devices for airships and more efficient docking facilities must soon come, in response to the demand both for use by globe-

Augustus Post, American aeronautical authority, who predicted Colonel Lindbergh's New York-to-Paris flight.

circling "Leviathans" of the sky, as well as the "iron pigs," "flying ash cans" and "pony blimps," as the small metal and fabric dirigibles are jokingly called. When the excellent features of the reliable dirigible balloon are fully realized, we are sure to have not only

(*Continued*)

Prof. Robert H. Goddard, Rocket Flight Expert, Gives His Predictions

I DOUBT if much will be done with rocket automobiles in 1930, but I look for more flights with rocket planes. In both cases, however, powder rockets will probably continue to be used, and long distances will therefore not be attained. This is because powder rockets, even when equipped with nozzles, have too little energy for long flights.

The very fact that bundles of powder rockets, having rather obvious limitations, have been used on planes has, I believe,

America is not yet fully alive to the possibilities of the rocket. —*Goddard.*

prejudiced American engineers against the rocket plane. What should be realized, however, is that with the entirely new and different system of rocket propulsion with liquid propellants, which I have developed, and in which the proportion of fuel to total weight is made large, a rocket plane should receive a much larger porportion of the energy content of the fuel than is possible with the ordinary airplane. In other words, the efficiency should exceed that of the latter.

Robert H. Goddard, Professor of Physics, Clark University, Worcester, Mass.

Actual operative flights of liquid-propellant rockets of the type necessary for long-distance

(*Continued*)

1930 will show increased patronage of passenger air lines on the part of the public, as a necessary adjunct in conducting modern business.—*"Casey" Jones.*

"Casey" Jones Sees Greater Use of Planes by Public

UNQUESTIONABLY the most interesting developments in 1929 in aviation which will be reflected in production in 1930, will result from various types of airplanes which are now being assembled at Mitchell Field to compete in the Guggenheim Safety Competition. While at the date of this article it is too early to predict just what the results will be, there are an extremely interesting number of machines entered in the competition, and the results on the matter of quick climb, controllability at low speeds, slow landing speed, and ability to get into small fields, are bound to result from this competition.

The autogiro is being successfully developed in this country and several concerns have accepted licenses to manufacture these. Again it is too early to predict what the final results of this development will be but present indications point to increased safety and popularity.

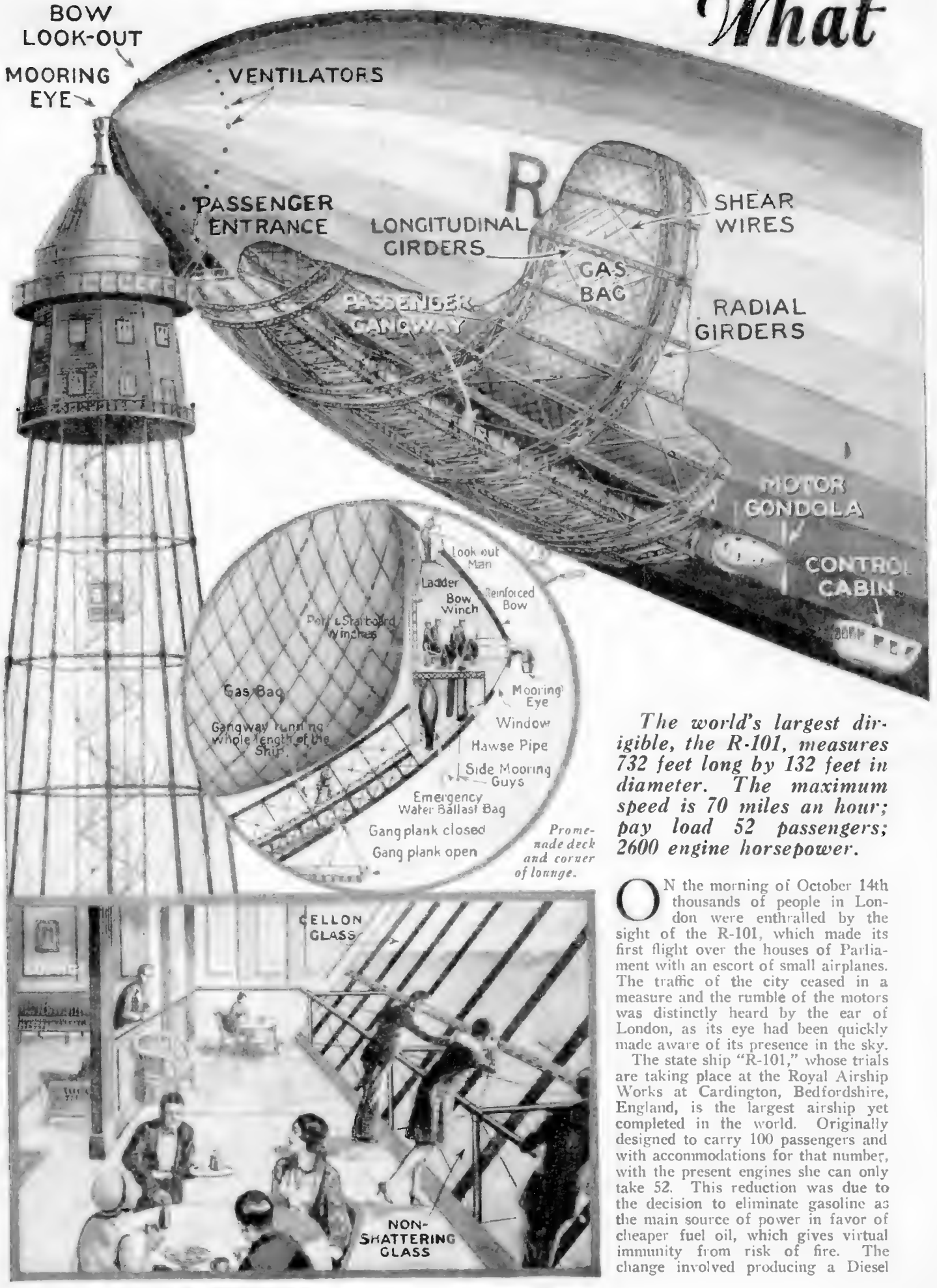
The year 1929 has shown an increased volume of air mail and with the adjustments in existing contracts, which may

(*Continued*)

Photo Curtiss Flying Service

C. S. (Casey) Jones, President of the Curtiss-Wright Flying Service.

What



The world's largest dirigible, the R-101, measures 732 feet long by 132 feet in diameter. The maximum speed is 70 miles an hour; pay load 52 passengers; 2600 engine horsepower.

ON the morning of October 14th thousands of people in London were enthralled by the sight of the R-101, which made its first flight over the houses of Parliament with an escort of small airplanes. The traffic of the city ceased in a measure and the rumble of the motors was distinctly heard by the ear of London, as its eye had been quickly made aware of its presence in the sky.

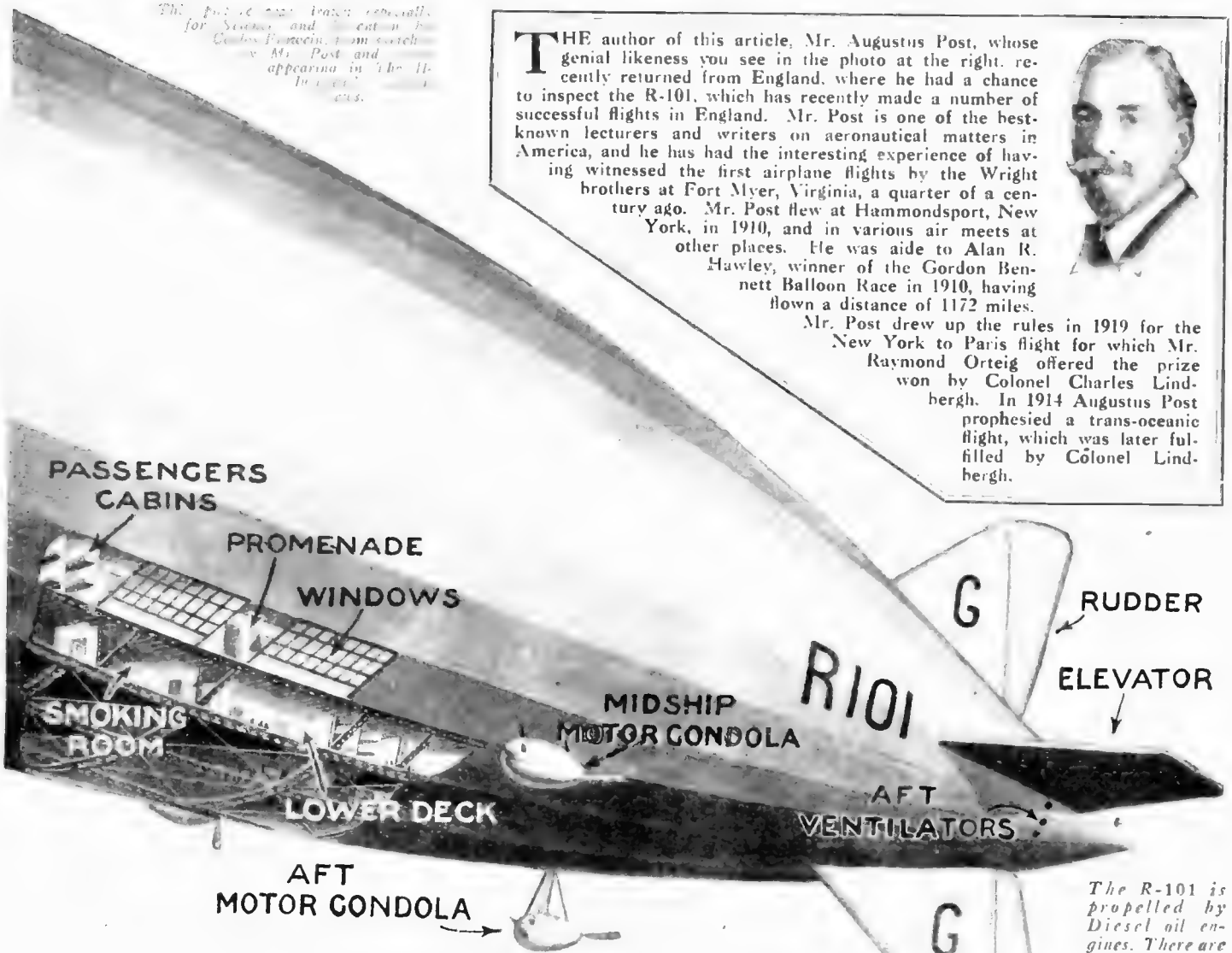
The state ship "R-101," whose trials are taking place at the Royal Airship Works at Cardington, Bedfordshire, England, is the largest airship yet completed in the world. Originally designed to carry 100 passengers and with accommodations for that number, with the present engines she can only take 52. This reduction was due to the decision to eliminate gasoline as the main source of power in favor of cheaper fuel oil, which gives virtual immunity from risk of fire. The change involved producing a Diesel

I Found on Board the R101

By Augustus Post

THE author of this article, Mr. Augustus Post, whose genial likeness you see in the photo at the right, recently returned from England, where he had a chance to inspect the R-101, which has recently made a number of successful flights in England. Mr. Post is one of the best-known lecturers and writers on aeronautical matters in America, and he has had the interesting experience of having witnessed the first airplane flights by the Wright brothers at Fort Myer, Virginia, a quarter of a century ago. Mr. Post flew at Hammondsport, New York, in 1910, and in various air meets at other places. He was aide to Alan R. Hawley, winner of the Gordon Bennett Balloon Race in 1910, having flown a distance of 1172 miles.

Mr. Post drew up the rules in 1919 for the New York to Paris flight for which Mr. Raymond Orteig offered the prize won by Colonel Charles Lindbergh. In 1914 Augustus Post prophesied a trans-oceanic flight, which was later fulfilled by Colonel Lindbergh.



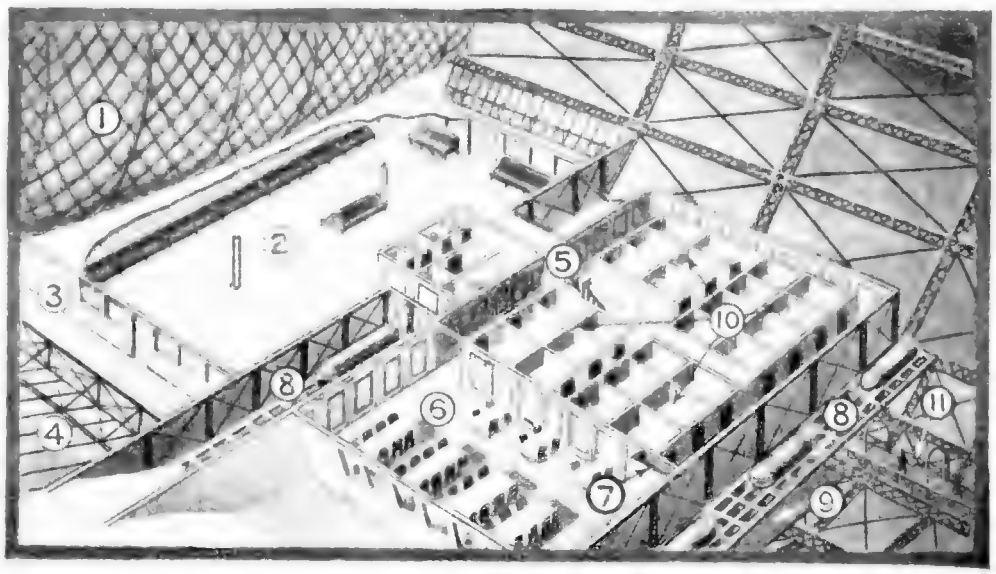
Upper deck: 1, gas bag; 2, lounge; 3, promenade; 4, windows; 5, staircase; 6, dining-room; 7, dumb-waiter; 8, balancing tanks; 9, lower deck; 10, cabins; 11, gangway from bow.

The R-101 is propelled by Diesel oil engines. There are five engines, each developing about 550 horse-power.

type of engine, of weight low enough for use in the air. The fact that the R-101 is the first airship to dispense with gasoline is an important step in progress.

The framework of the airship is of much larger cross-section than the corresponding part of the *Graf Zeppelin*, as it is designed to withstand strong rising air currents such as may be found in tropical countries, where they even range as high as 45 miles per hour. The passenger rooms are spacious and comfortable and are made chiefly of light wood, duraluminum and aluminum. The chairs and furniture are extremely light, although they present the apparent solidity of the furnishings of an ocean liner.

(*Continued on page* 840)



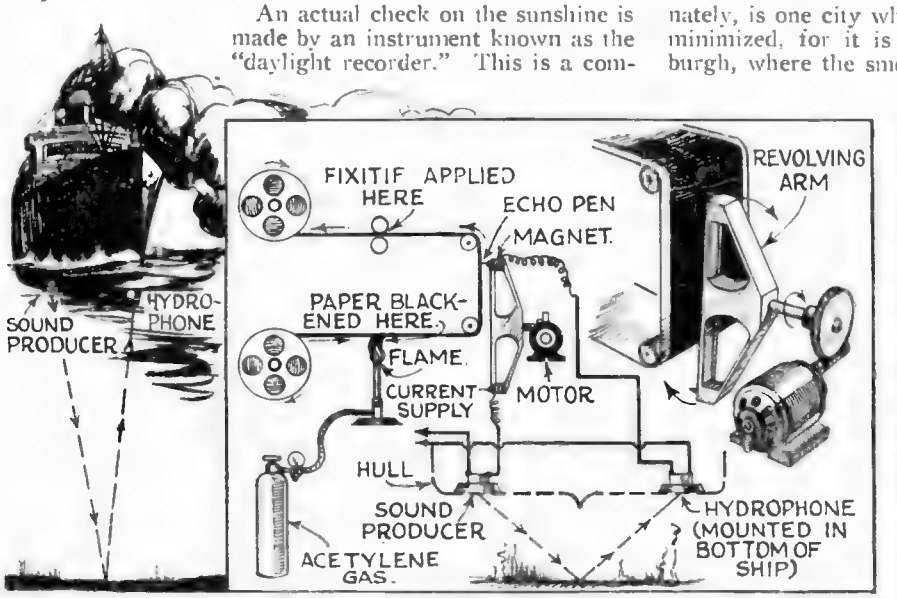
The photograph at the left shows New York's Health Commissioner Wynne studying the chart of the sunlight recorder in the office of the National Conference Board on Sanitation, as picked up by the photo-electric cell illustrated below.

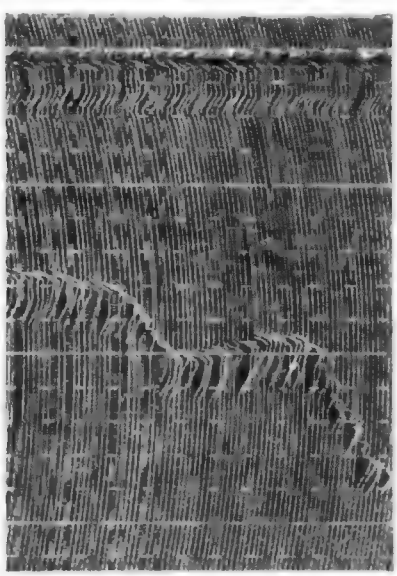
Soot Costs Taxpayers $96,000,000 a Year, So New York City Is Now Battling Smoke Nuisance

THE Department of Health of New York and New York City are waging war on the smoke nuisance which not only is detrimental to health and vegetation but also costs the taxpayers of New York City about $96,000,000 a year, or an average of $20.00 for every person in the city. The Health Department is combining a campaign of education and one of war against careless offenders. It has been definitely determined that most smoke and the resulting soot and dirt is caused by careless or inexperienced firemen or else faulty furnaces. All of these conditions can be remedied.

It has further been discovered that New York City receives only three-quarters of the sunshine that pours down upon it; the other quarter is blotted out by smoke. In the winter time as much as one-half the sunshine is cut off from the city because of this same condition.

An actual check on the sunshine is made by an instrument known as the "daylight recorder." This is a combination of an electrical resistance and a light-sensitive (photo-electrical) cell, together with a source of suitable current supply. The photo-electric cell reacts to the slightest change in light intensity. Such a change is duly recorded by the potentiometer (electrical balancing resistance) recorder. Photographs show smoke pouring from the funnel of a vessel in the Hudson River, and the others show Dr. Shirley W. Wynne, Health Commissioner of New York, examining the apparatus. This sensitive instrument has proven the fact that life for the city dweller is not as healthful as it possibly might be. New York, fortunately, is one city where the soot and smoke effect has been minimized, for it is not a great industrial city like Pittsburgh, where the smoke on a cloudy day is very noticeable.





How Smoke Records Ocean Depths

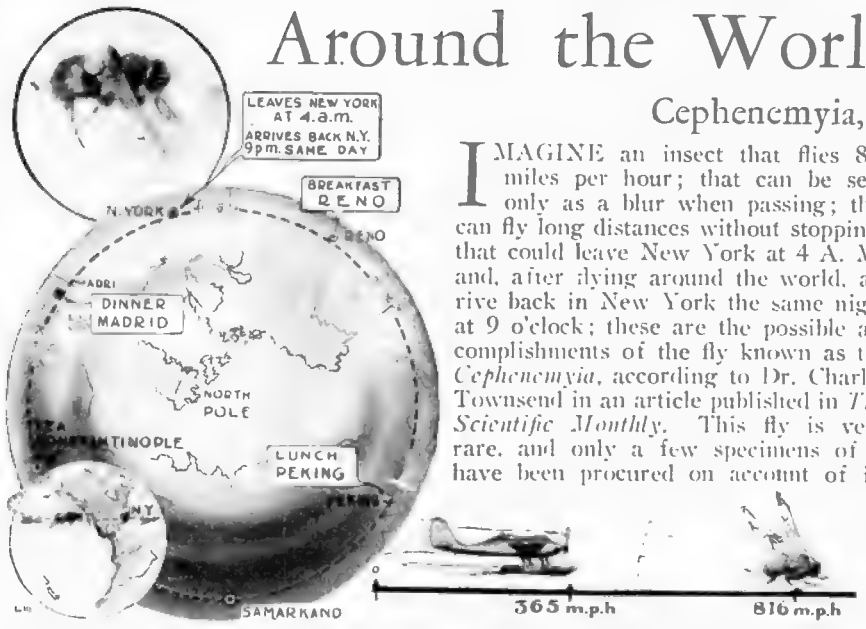
ABOVE we reproduce diagramatically the way in which one of our modern vessels, the *Ile de France*, makes records of the depth of the water through which it passes. A sound is sent out by a sound producer. This is reflected from the bottom of the ocean and picked up by a hydrophone mounted in the bottom of the ship. At the moment that the sound is produced a record is made on a blackened paper band. On the chart the first nick recorded indicates sound sent out; the lower nicks indicate reception of "echoes." If two seconds' time ensues between sending out sound and receiving echo, bottom is 4,000 ft. deep, as sound travels 4,000 ft. per second in water and had to travel down and return up. Underneath the paper band is a steady, smoke-producing flame. The flame is fed by acetylene gas.

Around the World in 17 Hours

Cephenemyia, Fastest Thing in Air

IMAGINE an insect that flies 850 miles per hour; that can be seen only as a blur when passing; that can fly long distances without stopping; that could leave New York at 4 A. M., and, after flying around the world, arrive back in New York the same night at 9 o'clock; these are the possible accomplishments of the fly known as the *Cephenemyia*, according to Dr. Charles Townsend in an article published in *The Scientific Monthly*. This fly is very rare, and only a few specimens of it have been procured on account of its extreme speed. But the few experiments performed with the specimens obtainable have proven that its speed as quoted above is true. If only this tremendous speed could be obtained by a man-made machine, think of the great advance in rapidity of transportation. For instance, if an airplane could attain the tremendous speed of 850 miles per hour, one could leave New York City at 4 A. M., have breakfast at Reno, stop off at Peking for lunch at noontime, take tea in Constantinople, dine in Madrid, and be back in New York at 9 P. M.

The Schneider Cup Races showed that aviation is still in its infancy. The Schneider Cup Races recently showed that a plane could acquire the speed of 365 m.p.h. with some degree of safety and we have it from the famous expert, Louis Blériot, that according to a graph of speed increases in motors since the beginning of aviation the speed of 750 m.p.h should soon be realized.

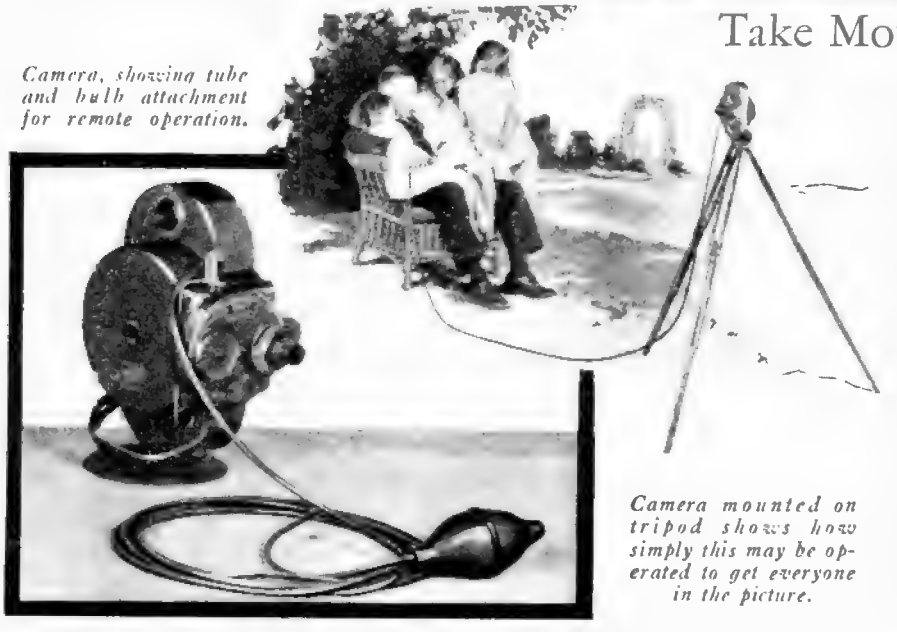


Above is diagram of the seventeen-hour 'round-the-world flight. Dotted line shows approximate path of plane.
At the upper left is a picture of the fly genus Cephenemyia. It is about the size of a bumblebee and three times as fast as an airplane.

Plane and Radio Speed Whaling

IN these days of scientific achievement Moby Dick would have no chance to chew off a man's leg and then beat it away. The good old whaling days of near-starvation and cruising for two or three months without sight of the big mountains of blubber are gone. First it was the power harpoon, steam-driven boats, and now airplane and radio. This newest wrinkle in the line of whale-hunting has been used by some Norwegian whalers in an expedition into the Arctic. The plane is equipped with a 220-horsepower motor, pontoons and skis, and with a full load of gasoline can remain in the air thirty hours. Its method is to fly short distances away from the whaling vessel, and on sighting a whale, the plane communicates with the ship by radio. The ship then races to the scene and proceeds to make the kill. This is demonstrated graphically in the sketch at the right.

Take Movies of Yourself

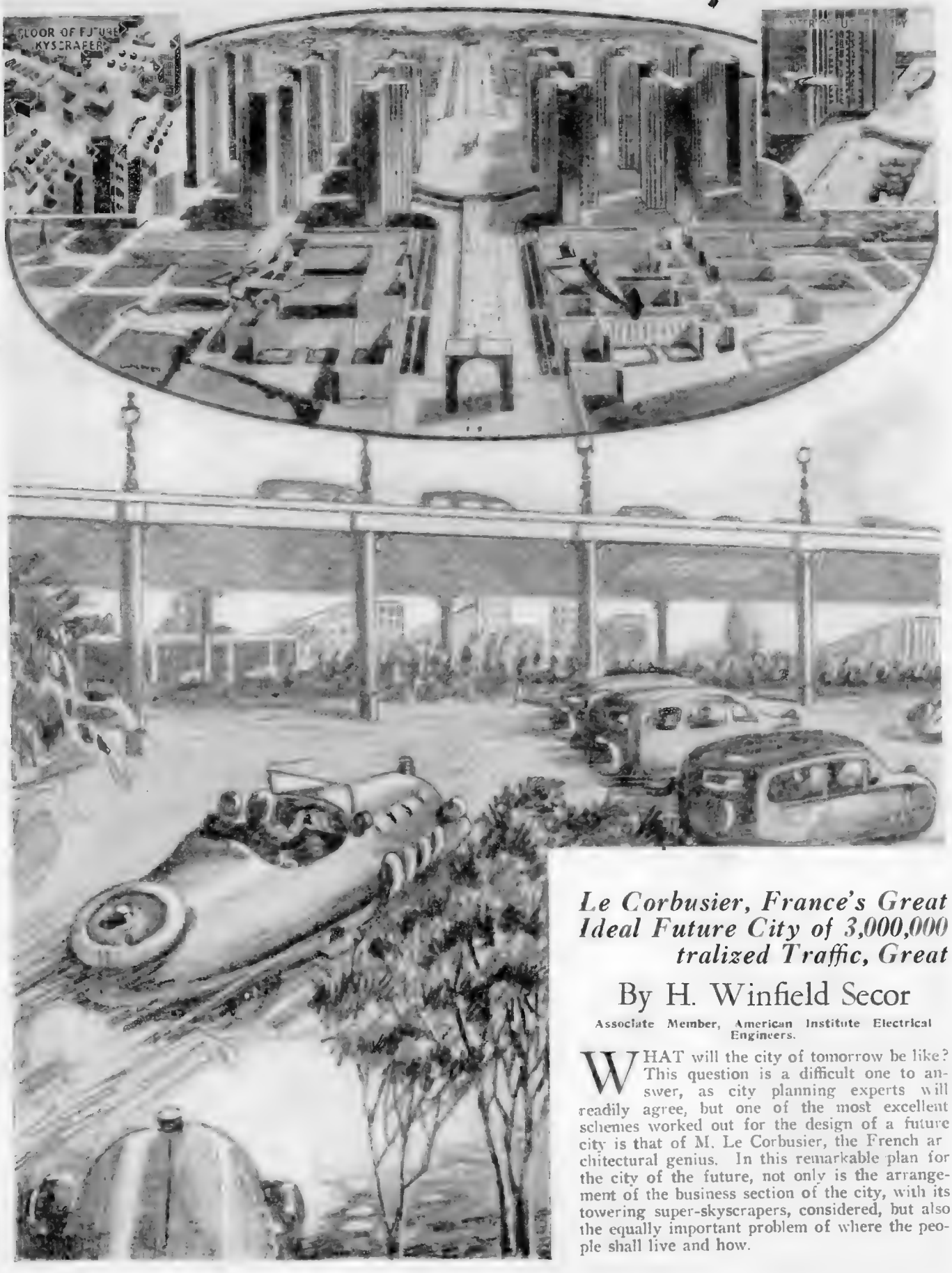


Camera, showing tube and bulb attachment for remote operation.

Camera mounted on tripod shows how simply this may be operated to get everyone in the picture.

THE greatest problem in taking pictures of the family has always been to get everyone in the picture. That was almost impossible because someone had to hold the camera. Usually a neighbor would consent to do so, but when one owns an expensive movie-camera he doesn't like anyone else to play with it. That problem has been solved by a well-known manufacturer of home cinema machines. They have attached a long rubber tube with an air bulb at the end of it. On pressing this bulb, the camera starts, and, presto! the movie is taken. This new device is something to add to the usefulness of the camera. It enables one to take pictures which otherwise might not be obtainable. For instance, in movies of nature study, one might place the camera at a certain point and keep out of sight of the animal and still get his pictures. And, as shown on the left, it is invaluable in photographing the family group.

THE CITY OF



Le Corbusier, France's Great Ideal Future City of 3,000,000 tralized Traffic, Great

By H. Winfield Secor

Associate Member, American Institute Electrical Engineers.

WHAT will the city of tomorrow be like? This question is a difficult one to answer, as city planning experts will readily agree, but one of the most excellent schemes worked out for the design of a future city is that of M. Le Corbusier, the French architectural genius. In this remarkable plan for the city of the future, not only is the arrangement of the business section of the city, with its towering super-skyscrapers, considered, but also the equally important problem of where the people shall live and how.

TOMORROW

Architectural Prophet, Visions With Super-Skyscrapers, Cen- Parks and Airdromes

M. Le Corbusier has planned his idealistic city to have a population of 3,000,000. As the illustrations show, he provides a concentrated business section at the center of the greater city, and here towering super-skyscrapers house the office workers during the day. As will be noticed, these skyscrapers are of a radically new design and the floors are virtually flooded with air and light, owing to the corrugated shape of the walls, which are supplied with plenty of windows. Aircraft may land on the roofs of the skyscrapers as well as on those of other buildings, and in the central business section there is a large, unified traffic terminal or station. This station has a great, circular airdrome or landing platform of

(*Turn the page*)

Future City *Plans Promise* Traffic Relief—*Better Light*

large area for planes and dirigibles. Below this platform there are other levels, reached by communicating stairways and elevators, where high-speed automobile traffic from north to south and east to west passes through the street level intersection. Below this one finds himself on the station platforms of the high-speed railroad system. Suburban sections are well served with trains operating on loops.

M. LE CORBUSIER'S dream of the future city is one of the most comprehensive plans ever proposed, taking into consideration as it does the handling of traffic, improved dwellings for the workers, as well as super-office buildings and airdromes right in the city.

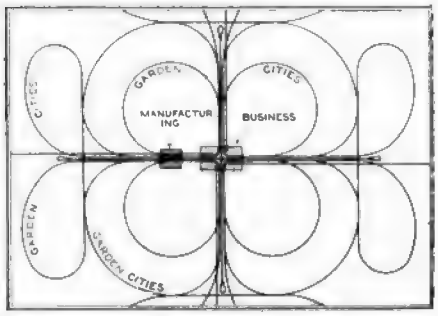
NEW YORK CITY WITH ITS HIGHLY CONGESTED SKYSCRAPER DISTRICT

The photo above shows lower New York City with its great mass of skyscrapers. Note that about 60 per cent of the ground area is covered with buildings and only a few per cent devoted to grass and trees, so greatly needed to purify the air.

One of the main arguments for this design of city is that while we may have a highly concentrated population in the business section or center of the great city of tomorrow, traffic, especially with regard to automobiles and trains, should be simplified. In this most comprehensive and promising plan of Le Corbusier's, the matter of caring for the traffic would seem to be well worked out. It is only a matter of having the principal arteries of traffic made large enough to take care of a great many automobiles or trains. In other words, this genius' idea is to have a few large arteries of traffic separated a much greater distance than is the present plan in practically all of our cities today.

Among the many practical details which are presented in Le Corbusier's plan for the city of tomorrow he has given careful study to the health and welfare of the population. Instead of covering, say 50 to 60 per cent or more of the area of the city's ground with buildings, with a few trees in small parks spaced half a mile or more apart, he has designed skyscrapers and residential buildings of a type which only occupy about 5 per cent of the ground area, leaving 95 per cent of the ground for trees, grass, lakes, etc. People need pure air, even in the city, if they are to be thoroughly healthy and accomplish their work properly. One of the accompanying pictures shows in how great proportion the park (or tree and grass) area in a city like New York would be increased if M. Le Corbusier's plan were applied instead of the present one, where one can see nothing but buildings studding practically the whole ground area, when viewed from an airplane.

The general plan of the great future city and its environs calls for a centralized business section, where the skyscrapers are surrounded by a considerable number of residential blocks, liberally interspersed with parks. The main boulevards carrying motor traffic would then lead across intervening country (protected zones) to so-called "garden cities," where plenty of green trees and grass would provide a very healthy and delightful living section. Large lakes and woodland would be found in the intervening protected zones, between the central part of the city and the garden cities.



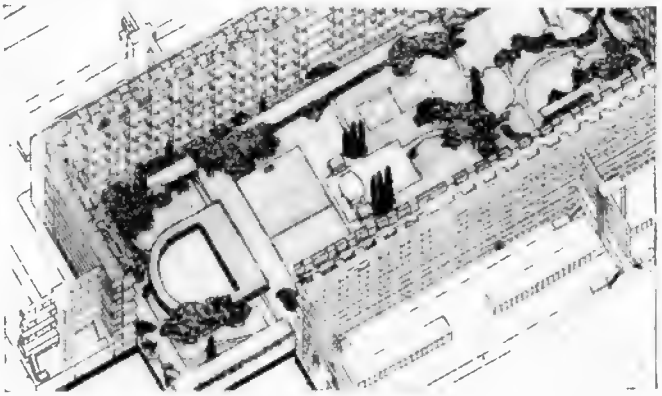
Plan of the City of Tomorrow centralized railroad system as visualized by Le Corbusier. The business and manufacturing centers are localized; the people may live in cellular type dwellings adjacent to the business section or in the suburban garden cities served by the railroad loops. Picture at right—one of the plans for housing the people in dwellings built on the "cellular" system. Note the large park area.

With regard to the super-skyscrapers of the type here proposed, examination of the typical floor plan as shown in one of the accompanying pictures, reveals the fact that the buildings are designed in the form of a cross, thus doing away with an internal court and giving maximum stability to the structure. The façades are deeply serrated and form veritable traps for light. The capacity of one of these super-skyscrapers 460 feet long and 700 feet high is 30,000 employes, allowing 10 square yards per person; while one of these skyscrapers 540 feet long would have a capacity of 40,000 people. Long roads of compact garages, multiple floors of which may be placed underground with elevators or ramps, are to be found on the ground level, and these garages are placed in the angles between the wings of the skyscrapers. All motor-car traffic is gyratory. A peculiar sight strikes one's eyes on the ground level as the skyscrapers are not walled in, but one sees the numerous steel columns which carry the sixty stories. This leaves open space for freight storage, etc. The elevator and stairway shafts are enclosed, but the frames are open. It is a fact not often realized perhaps that if one took away the outer foundation wall from under one of our present-day skyscrapers, the skyscraper would still be safely supported by the steel and concrete piles underneath it, which go down to a solid footing.

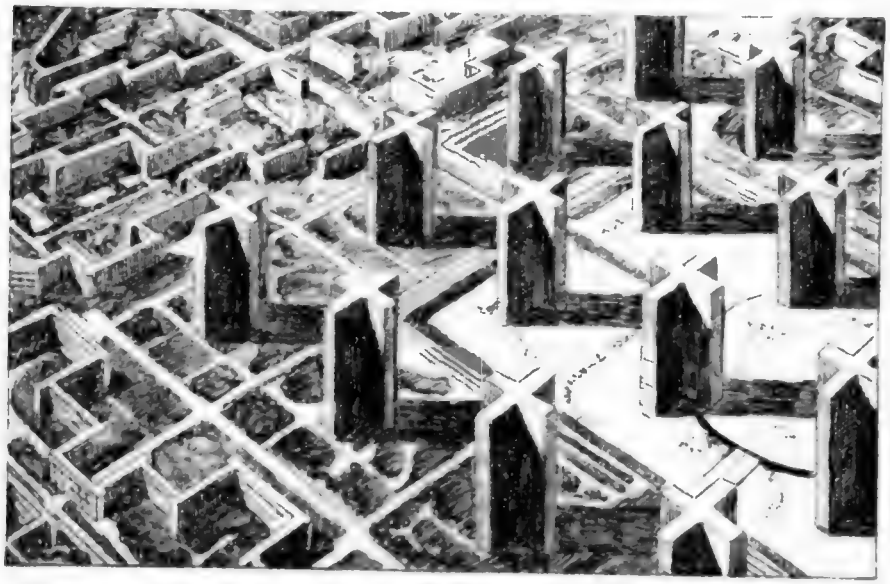
M. Le Corbusier, in one of the chapters on "a typical working day" in the future city, as given in his remarkable new work, *The City of Tomorrow*,* says: "It is 9 A. M. . . .

"From its four vomitories, each 250 yards wide, the station disgorges the travelers from the suburbs. The

*Just published by Payson and Clark, Ltd., of New York City.



More Parks—*Centralized Rail Terminal*—Roof Airports



AS NEW YORK WOULD LOOK WITH LE CORBUSIER'S PLAN IN EFFECT

Lower New York as Le Corbusier would lay it out, with buildings occupying about 5 per cent of the ground area, the rest being devoted to air-purifying parks.

THE plan here presented for the City of Tomorrow calls for a population of 3,000,000, but it can be enlarged to any desired scale. The skyscrapers of improved type giving more light and air are about 450 feet across and 700 feet high. All traffic lines are centralized.

trains, running in one direction only, follow one another at one-minute intervals. (In Berlin at the 'Zoo' station, where many lines meet, this masterpiece of precision has been in operation for years.) The station square is so enormous that everybody can make straight to his work without crowding or difficulty.

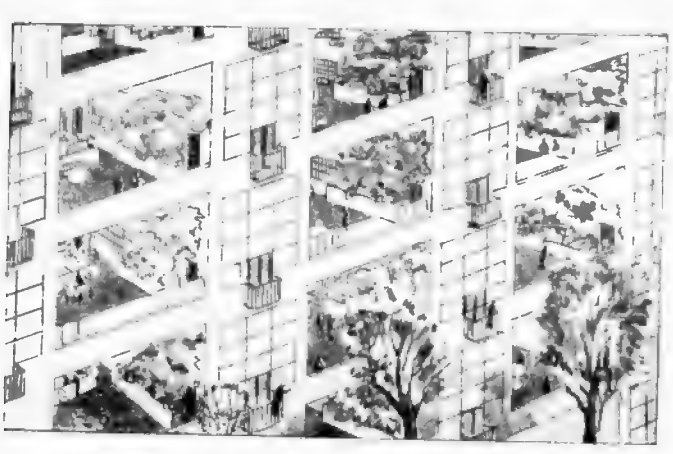
"Underground the tube taps the suburban lines at various points and discharges its passengers into the basements of the skyscrapers, which gradually fill up. Every skyscraper is a tube station.

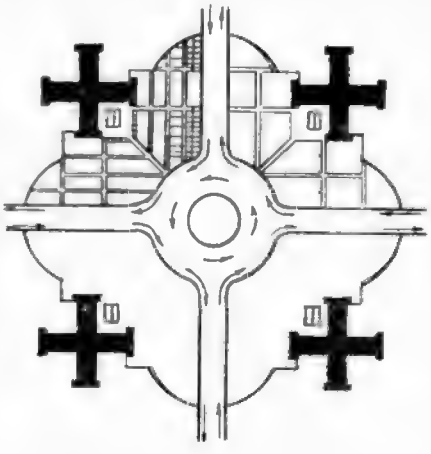
"A skyscraper is, in fact, a whole district, but verticalized! Ten thousand to fifty thousand employes pass their day in it, each with a minimum superficial area of ten square yards to work in. The original and primitive conception of the skyscraper comes to us from America; but if the disposition of these shown in my scheme is compared with an aerial photograph of New York, where the skyscraper completely holds up Manhattan, it will be seen how great is the contrast between the latter and a rational and clear conception where a large outlook has been the deciding factor in the relation to each other of these indispensable elements. In New York City 20,000 people invade a narrow street at practically one moment, and the result is complete chaos; all fast traffic is paralyzed and the idea for which the skyscraper stands is robbed of all significance. Created for the purpose of decongestion, actually it slows up all traffic and is, in fact, a powerful factor for congestion. The result is that people cry out against the skyscraper and the vertically built city, and because of the need to get about quickly, oppose the type of city which is spread out over a very large area. So we have a new paradox. Since New York City (Manhattan) is to some extent an absurdity, the whole idea is vehemently attacked. The truth is that the skyscraper, as we have it in New York, will not do, for by means of it New York has increased its density to too great an extent, without proper provision for the necessary approaches. New York City is wrong, but the skyscraper remains a noble instrument. But if you are going to increase the density of your population, you must at the same time make full provision for getting it away. There are two sides of a medal; one cannot exist without the other. . . . In a few moments the city fills up. Work begins and, speeded up by efficient organization, goes on busily in luminous and even radiant offices whose immense windows open full on the sky and the lofty horizon, where the air is pure and noise far distant.

"Then, perhaps, the working day may finish after midday. The city will empty as though by a deep breath. The *garden cities* will play their full part. And, on the other hand, in the city itself the residential quarters will offer new living conditions to these new men of a mechanical age."

Thus does the prophetic French architect paint the picture of a business day in the city of tomorrow. Doubtless we shall also have new forms of heat and light when the coming generation takes office. Radio telephones will be found in all offices and automobiles will be driven by some new form of fuel, possibly by electric waves.

As some of the accompanying illustrations indicate, the residential angle of the future city has been carefully studied and one of the main underlying ideas is to provide residential apartments arranged in long winding strips, one type of which M. Le Corbusier calls *blocks of dwellings with setbacks*. Another suggested style of residence he calls *dwellings built on the cellular system;* the height of the building for example in the cellular plan is 110 feet above the ground. The "building" is made so narrow that plenty of fresh air and sunlight flood the rooms at practically all times. Furthermore, practically 95 per cent of the ground area can be devoted to lakes, green grass and (*Continued on page* 834)





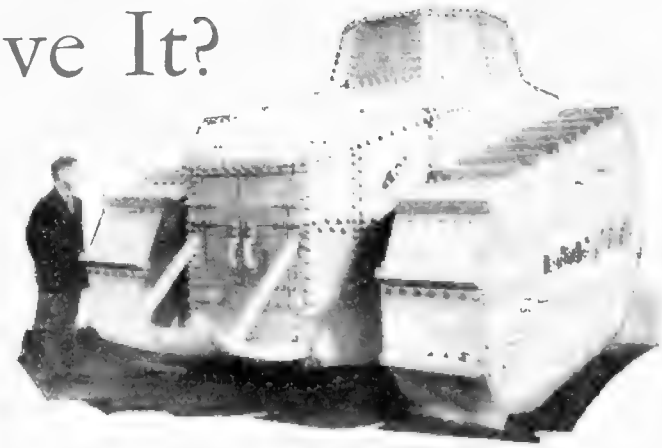
The picture at the left shows a close-up of blocks of dwellings built on the "cellular" system proposed by Le Corbusier. The buildings are ten stories high. Plan at right shows street crossings for fast auto traffic in future city. All traffic is gyratory.

Would You Believe It?

Photographic Proof of Facts Stranger Than Fiction

A Real "Shrinking" Man

"THEY tell me I could live 50 years with the malady. If I do, and I continue at my present rate of shrinkage, I could hide behind a shoe box at that time!" Joseph Mayott, World and Spanish-American war veteran, and one of the strangest cases known to medical science, is suffering from what is termed Paget's disease. He has lost nine inches in stature in the past eight years—a little more than an inch a year—and today he is 4 feet 10 inches instead of his normal 5 feet 7 inches. Over 400 doctors have examined him and agree that Mayott's condition need not necessarily prove fatal, and he could live 50 years more!



Look Out for This Monster Tank!

THIS monster, latest type of armored tank, is as harmless as a flea on a wet dog. It's made of 135 pounds of SOAP! It measures 5.5 meters in length and is 3.5 meters high. This example of careful workmanship was recently exhibited in Berlin at the Soap Exposition.

The above metric measurement, translated into terms of the English system of measurement, would give this tank a length of about 18 feet and an approximate height of 11½ feet. Since an average cake of soap weighs about three ounces, this destroyer of dirt makes enough soap for over 700 families.

This Melon Grew in This Bottle

CAPTAIN John A. Gilman, of the Quartermaster Corps at Washington, explains to visitors, who have vainly endeavored to solve how this melon grew in a five-gallon bottle, that he merely inserted the vine producing the bud in the bottle when the fruit was about the size of an olive.

A Miniature Giant of the Sea

THE "Columbus" scale model, shown beside a model of the old "Santa Maria," is equipped with gas engine drive. The model cost $4,000. Note head of operator and boy on deck.

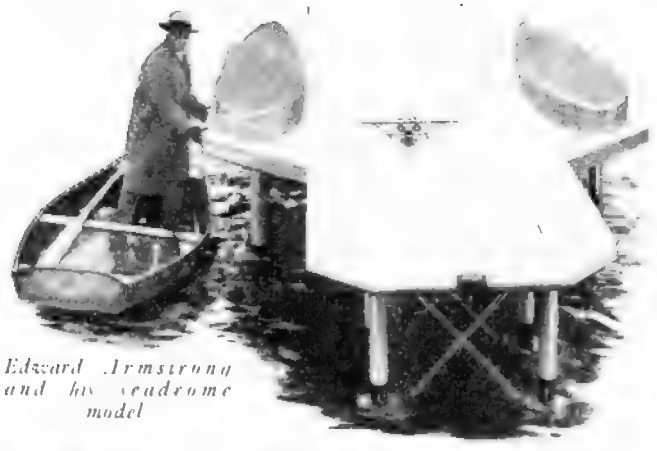
A "Roller Coaster" Bridge

THIS gracefully curved $6,000,000 Bridge over the Cooper River, South Carolina, although higher than the Brooklyn Bridge in one part, sweeps to within 50 feet of the water at another point.

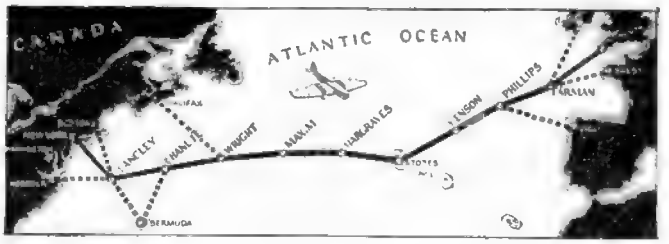
Gallway

The "Queerest" Elevator

IF you visit Meteora Monastery in Thessaly, you will have to go up in the basket you see in the picture unless you prefer to climb doubtful looking ladders. Ever so, it is a long way up to the spot where you get the basket. This is the refuge for which the Meteora group of seven were named. Monks of the Greek Church built these refuges as a protection against mountain bandits.



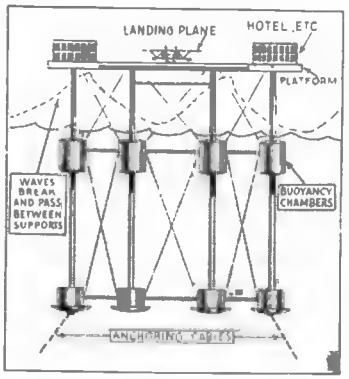
Edward Armstrong and his seadrome model



Above diagram shows various places, from America to Europe, where it is proposed to anchor the seadromes.

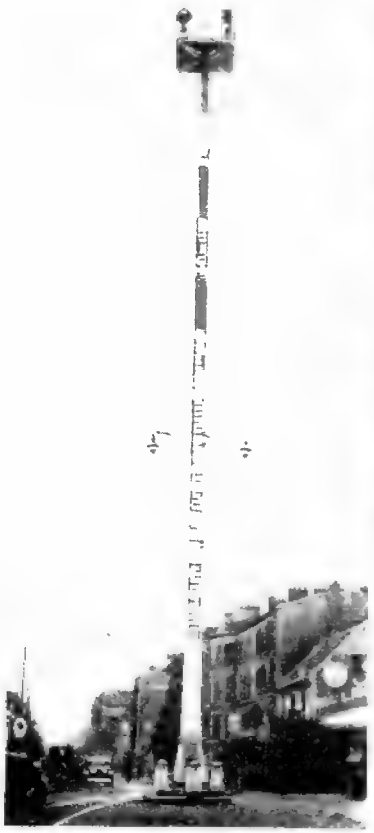
MID-OCEAN AIRCRAFT STATIONS

At left is shown portion of seadrome which projects into sea. Below, diagrammatic view of seadrome in water.



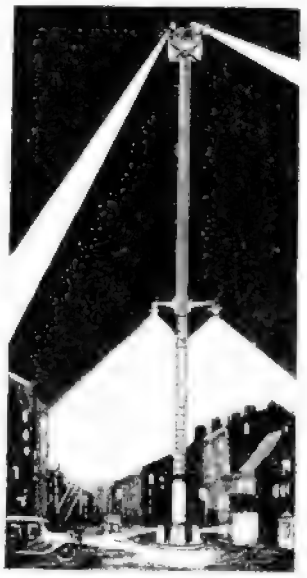
RECENT experiments with the seadrome invented by Edward Armstrong, consulting engineer, have shown that such man-made landing stations for trans-oceanic air travel are quite practical. In Chesapeake Bay, a model 1/32 of the full size has been subjected to cross-currents, wind, waves, and choppy seas, and has weathered every test. The model used was 35 feet long, 11 feet high, 10½ feet wide, and weighed 2200 pounds. The full size seadrome soon to be constructed and anchored between New York and Bermuda will be 32 times larger. It will provide large hangars, and storehouses, landing space for planes, as well as a hotel for the travelers. it will have the enormous draft of 172 feet; this will eliminate all pitching and tossing due to large waves. It will rise 92 feet above the level of the water, and be suitably marked for identification by the airplane pilots. It is planned to install eight across the Atlantic.

MORE *and* BETTER LIGHTS *Safeguard Life and Property on* LAND *and* SEA



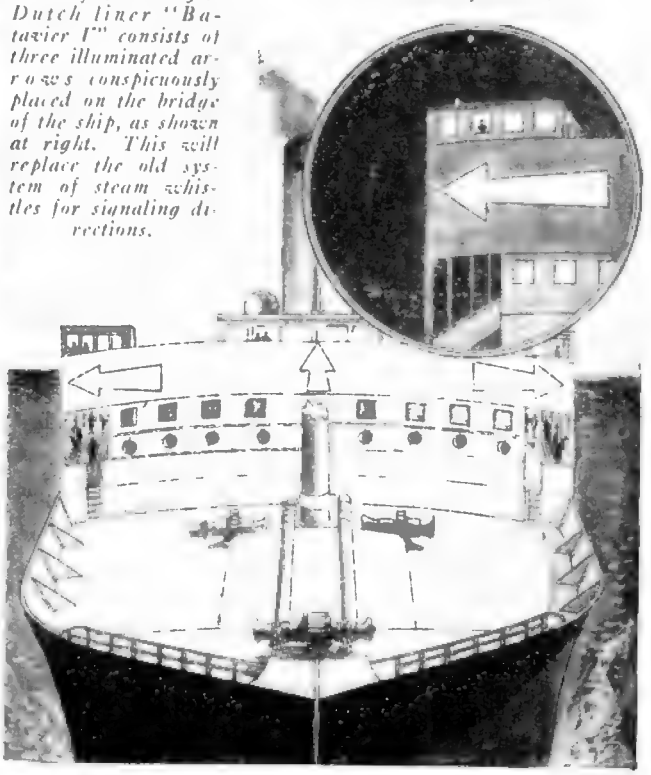
France Lights the Way to Better Traffic Direction

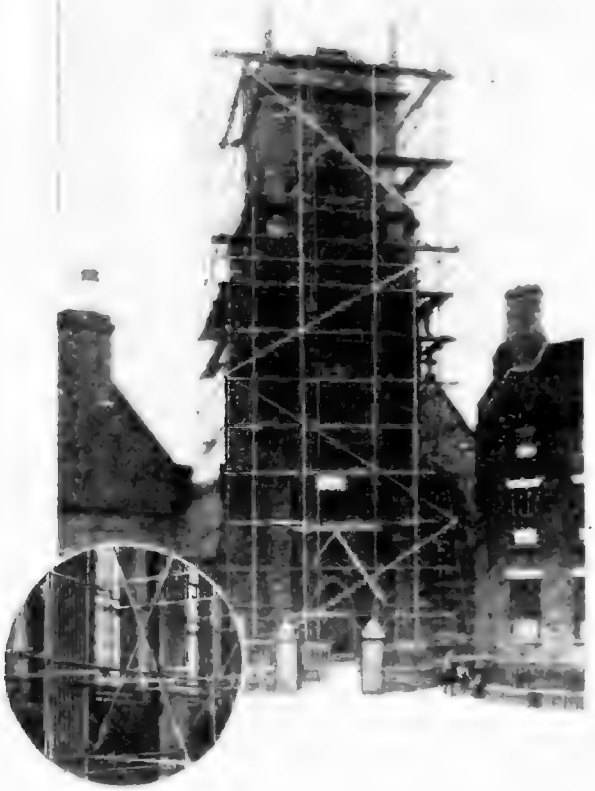
The quaint little town of St. Denis, France, has recently inaugurated what is regarded as the tallest traffic tower in existence. Four searchlights, eighty feet above the ground, project in each direction. Half-way up the tower are brilliant lights which illuminate the square.



The new optical system of the Royal Dutch liner "Batavier I" consists of three illuminated arrows conspicuously placed on the bridge of the ship, as shown at right. This will replace the old system of steam whistles for signaling directions.

Lighted Arrows Show Direction of Liners





Steel Tubes Make Fine Scaffolds

"SCAFFOLDTUBE," steel tubular scaffolding used on this church tower, permits an open construction, due to its great strength. This method offers lower resistance to wind pressure and a much less unsightly effect results. Insert shows this method used during the redecoration of the Town Hall of Birmingham, England. The hall was used during the entire work of renovation, the tubes being painted to match the decorations and being scarcely noticeable.

Autos Cross Mountains on Trains

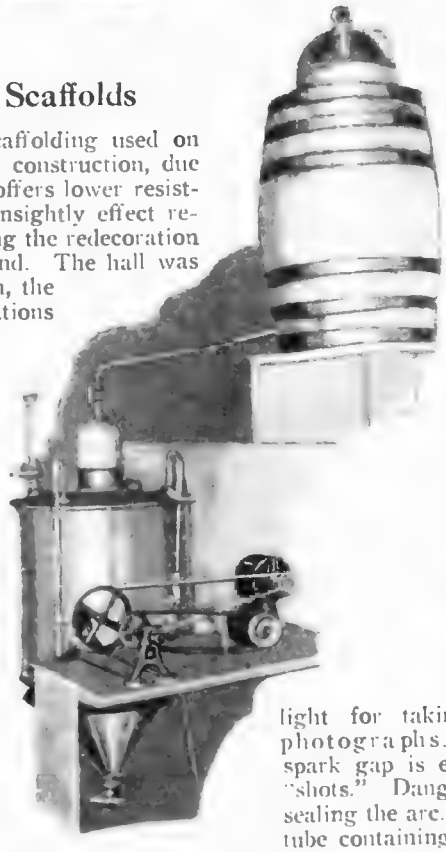
MOTORISTS are now enabled to conquer the Sierra Nevada range in midwinter. By the special service between Sacramento, California, and Reno, Nevada, they can check their cars in this baggage car at about 10 cents a mile.

In the Spotlight

Flashes from far corners

Electric Flashlights for Taking Photos

DR. L. F. CURTISS, a physicist of the U. S. Bureau of Standards, is shown with his electric flash-



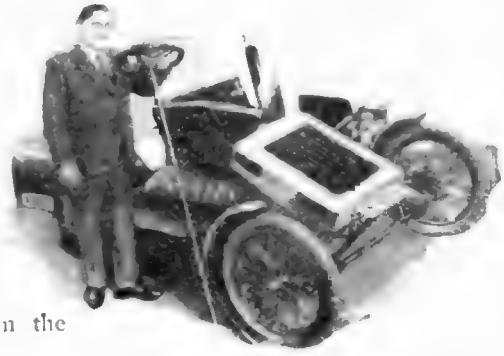
light for taking instantaneous photographs. This mercury spark gap is especially suitable for exceptionally fast "shots." Danger from mercury vapor is eliminated by sealing the arc. The spark gap consists of a pyrex glass tube containing mercury, with a heating coil around it.

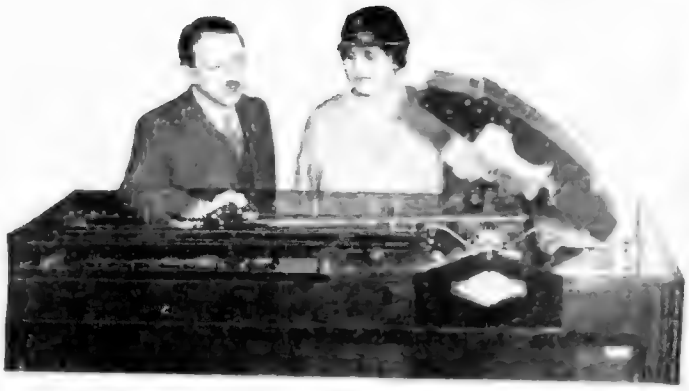
Corn Stalks Turned Into Gas

HOUSEHOLD wastes and corn stalks, ordinarily left to decay, can now be utilized to provide a gaseous mixture of carbon dioxide and methane or marsh gas. This gas has a heat value nearly equal to that of gas supplied cities and can be used to run a generator to charge storage batteries thus supplying farms with electric light and power. The apparatus converting corn stalks and wastes into gas was used in experiments by Professor A. M. Buswell of the University of Illinois and his assistant, Mr. C. S. Boruff.

An Automobile for the "White-Collar" Worker

THESE two photos show a new folding automobile recently tested in Berlin, Germany. The price and practicability of this vehicle places it in the reach of all classes. It costs about $350 and can be readily dissembled for storage when garages are unavailable. The inventor, Heinrich Zaschka of Berlin, is shown in the photos.



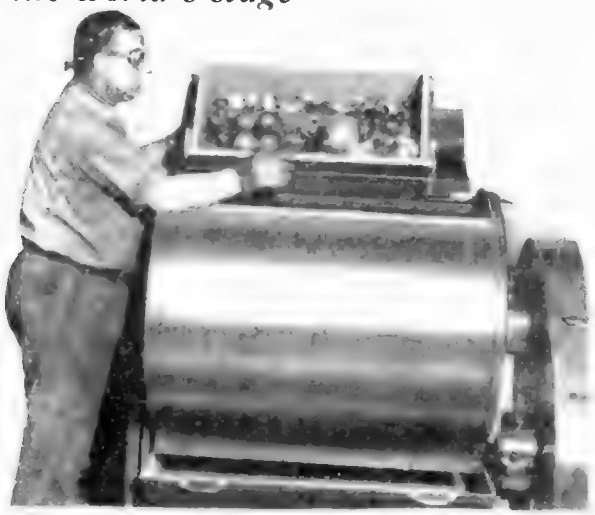


Self-Playing Violin Has Real Technique

THIS violinista, recently shown in New York, is controlled by perforated paper rolls. It uses a standard bow entirely free at its points and held only at its heel.

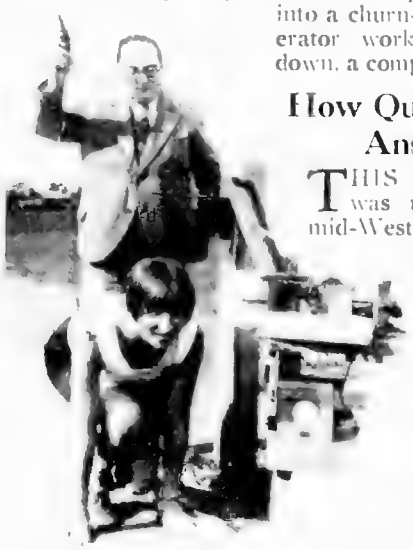
of Science

of the world's stage



Meet Mr. Rumbler, Who "Chews" Glass

A BARRELFUL of old incandescent lamps can be poured into this machine which, with crashing and popping noises, threshes the glass off the brass bases. The New York Edison Company uses this machine to salvage this brass. The machine will smash about 300,000 burned-out lamps a year. Formerly lamps were broken by hand. They were put into a churn-like barrel and the operator worked a dasher up and down, a comparatively slow method.



How Quick Do Athletes Answer Gun?

THIS electrical timer, which was recently tested in the mid-West, shows the time it requires a person to physically react to the sound of a starting gun. The firing of the gun is instantly recorded on a graph and the elapsed time before the foot leaves a ground-contact is also then recorded. Races are often won by "beating the gun."

Compressed Air Auto

TRIALS were recently made at Essen, Germany, by the German inventor, Max Valier, who is known for his experiments with a rocket-propelled automobile. This new type of car utilizes compressed air. The car runs quite noiselessly, and it is claimed that the danger associated with rocket-propelled cars is eliminated. The photo shows Max Valier demonstrating his car before an enthusiastic audience. The cylinders containing the compressed air can be seen.

"Electric Matches" for Texas Oil Fields

THE electric "matchbox" shown in this photo has replaced matches on oil fields in the Beaumont section of Texas. In order to reduce possible fire hazard, workers are forbidden to carry matches on their person. However, to give employes an opportunity for smoking, the companies erected a number of these electric lighters on isolated sections of the fields. The lighters are protected so that the current will not injure the user.

Newest Ideas

Greater Safety in the Air Is

Gathered from the Flying

Tandem Monoplane

THIS two-motored tandem monoplane was recently tested at Roosevelt Field, New York. The plane is claimed to be non-stallable, and the tricycle landing gear, clearly shown in this photo, prevents turnovers when making a bad landing.

Moving Wing Stops Stalls

MR. W. SCOTTER, at the International Inventions Exhibition, Central Hall, Westminster, England, with his moving wing plane, which he claims will not stall, and can ascend and descend in a small area.

Land Planes Kept Afloat

Photo at left shows disabled land plane safe afloat by automatically inflated bags.

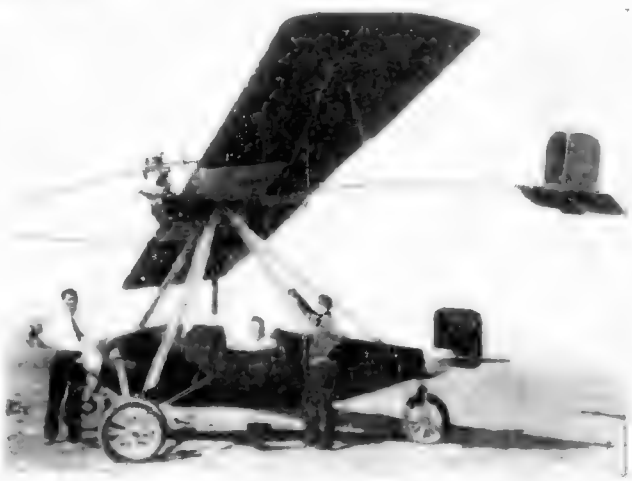
THE U. S. Navy has adopted a "flotation gear" to keep bombers afloat when forced to descend in the water. Barrel-shaped gas-proof bags are normally folded in compartments in the body. A lever alongside the pilot controls the valve of a gas container, which automatically opens the compartments, ejects and fills the bags in about ten seconds.—J. W. S.

Seaplane "Drydock" for Open Water

THIS special pontoon is especially adaptable for towing planes from small inlets into rough, open water, where they can be safely launched. It can also serve as an emergency drydock when repairs must be made or it can be used as a mooring nest when the water becomes exceptionally rough. This landing pontoon was first used at Calshot, England.

Fins and Flippers for Flyers

VERTICAL fins under upper wing prevent side-slips, and flippers in front control fore-and-aft stability. This invention of Dr. C. M. Vance of Pomona, California, successfully underwent a rigid test flight at the Los Angeles Field.



Fuselage Always Level

THIS unique craft is a monoplane, with the fuselage swung about six feet below the wings by means of six streamlined struts, as shown in the photo. The motor is situated on the wing. By means of a giant universal joint behind the motor, the fuselage with cockpit will ride level at all times, regardless of whether the craft is taking off or landing. The inventor, Rolla V. Norris, of Porterville, California, is seen in the cockpit of his machine.

Family "Flivvair"

THIS folding plane, designed by Col. Clarence Chamberlain, measures only 10 feet by 25 feet with wings folded back. It should appeal with its flying speed of 135 miles per hour.

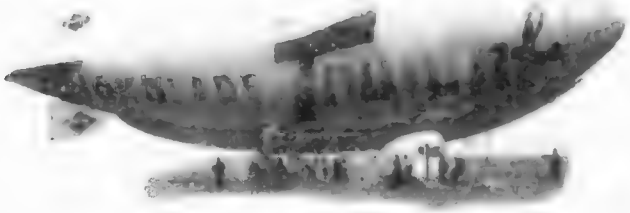
In Aviation

the Keynote of Recent Inventions

Fields, by our Aero Editor

Airship of the Future?

STATIC lift of the dirigible combined with the dynamic lift of airplane wings, will make this strange craft the "Air Leviathan" of the future, it is claimed by its inventor, John Hodgdon of Long Beach, California. Presence of the wings will prevent rolling and pitching common generally with blimps, and it will also be possible to land with motors running, without the aid of a ground crew.



Baby Airships

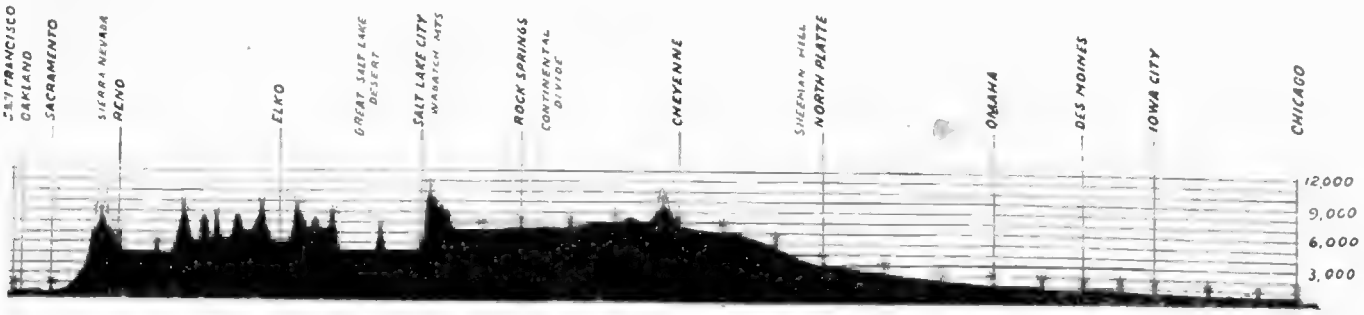
A FEW of the large European advertisers are turning to baby blimps to advertise their product. The message is painted on the sides.

Radio Interference Stopped

THE shields, which may be seen on the motor in the illustration, serve to prevent the setting up of waves which would ordinarily interfere with radio inter-communication.

Wheel Shock Absorbers

THE Goodyear "air wheels" take the place of shock absorbers. Air resistance is reduced by streamlining this combined wheel and shock absorber.



Longest Lighted Airway in the World

THIS air-mail express and passenger route, covering about 2,000 miles is virtually a lighted air boulevard. Emergency landing fields are found every twenty miles, a revolving 24-inch beacon every ten miles, and flashing blinkers each three miles.

Henry Ford's Museum

Will House

Edison's Early Shop

for Future Generations

Fig. 1. Here is the old pedal organ used by Edison in experimenting with sound.

FIFTY years ago the world was startled by the invention of a young genius of America. The fact that man had created a light which was smokeless, flameless, and sootless was hard to realize. It was even harder to realize when the inventor was revealed as a modest young man, Thomas A. Edison, with a very meagre and limited laboratory. His only workshops were a few modest little shacks in the small suburban town of Menlo Park, New Jersey. His knowledge of the principles of physics and chemistry was almost as meagre as his laboratories, but he triumphed in spite of these obstacles. Today, a half century later, another celebrated American, Henry Ford, has paid Thomas Edison a great compliment. Mr. Ford has reconstructed this same laboratory, these same rooms, and the same apparatus which gave birth to this great invention, in his museum at Dearborn. No expense has been spared and no pains have been too great to reconstruct the entire setting in its original form. Mr. Ford has even brought soil from Menlo Park, and all the buildings are reproduced faithfully; some are 70 per cent and others are 90 per cent genuine.

The old pedal organ, on which Edison gained his knowledge of the principles of sound, is found here in its final resting place. Here also is the chemical laboratory in which Edison worked. On the shelves are his original chemical reagent bottles with their ancient labels intact. And then there is the old mercury vacuum pump with which Edison evacuated his first successful incandescent lamp. Here also is the old shack in which Edison made some of his first glass-blowing tests. Besides these there are many other relics of the inventor's youthful work in New Jersey.

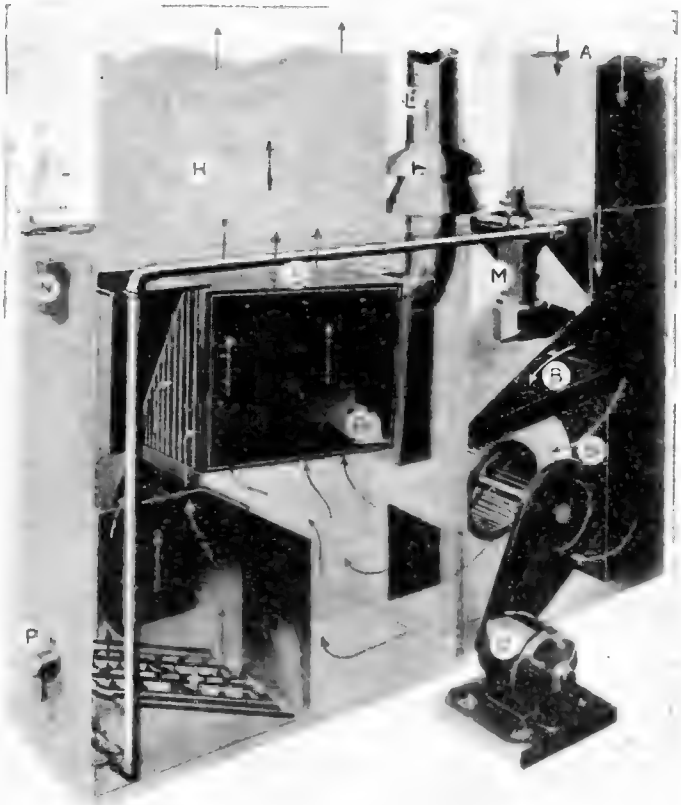
This museum was opened with a great celebration by Ford on October 21st. A list of 800 guests, headed by the most prominent men in every field of endeavor in the country, attended the party. Edison met these men at Detroit and with Mr. Ford they entrained for Dearborn, where Edison performed many of the experiments he had originally done many years ago. He exhausted a lamp, set up a circuit and lit the bulb as he did fifty years ago. The whole program was carried throughout the world by radio, and millions of listeners joined in this great tribute to one of America's great men. Two features of this program were the speaking of President Hoover from Dearborn and the congratulatory speech of Albert Einstein.

Fig. 2. Shows the various shelves of chemical reagents of Edison with the original labels still intact.

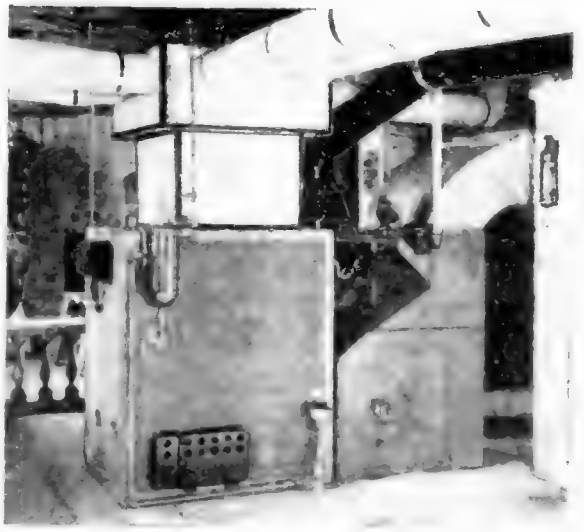
Fig. 3. This is the original laboratory which Edison used for his glass-blowing tests.

Fig. 4. The Wizard of Menlo Park evacuated the first incandescent bulb with this vacuum pump.

Above is another view in the famous first laboratory of Edison.



Above view shows how air is brought in through incoming duct "A," drawn through filters "B" by rotary blower "C" (operated by exterior motor "D"), forced through heat interchanger "E," into humidifier "F," into mixing chamber "H" and into house. "M" thermostat, "N" excess heat control. "P" is the pilot governing the gas flame. Escape of gas, fumes, or carbon is provided through backdraft diverter "K" and flue "L."

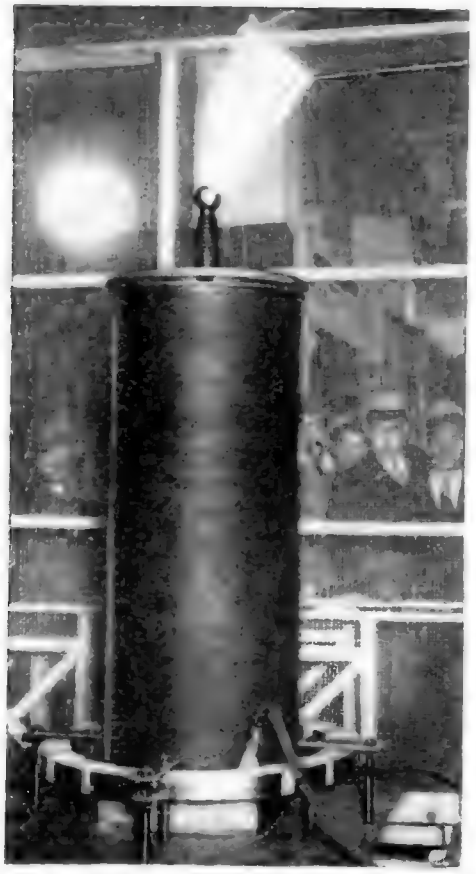


Above shows general view of humidifying furnace.

Made-to-Order Weather *for* Your Home

A NEW furnace, operated by gas, has recently been designed by a prominent thermal engineer to regulate the relative humidity of the home as well as the heat temperature. It is a well-known experience that the pan of water placed on top of a stove or radiator does very little to efficiently counteract that annoying dryness of the mucous membrane in the nose. And that may not surprise anyone if he knows that it takes twelve gallons of water per day to keep the relative humidity of a six-room house normal. This furnace is well designed and is suited exactly for the small house owner. The technical details are simple: the air is drawn in by a duct and the dust removed by fine wire-meshed screens. A centrifugal blower now carries the air into the heating chamber, and after being heated by gas, it is passed through a humidifier; the heated air is then blown through conveying pipes to the different rooms.

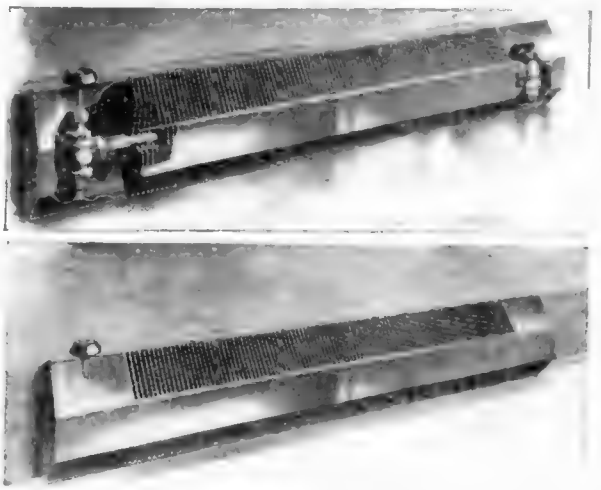
A Quarter Million Volts



AT the left is shown a giant Oudin coil, one of the spectacles at the recent Radio World's Fair in New York. This coil was operated from an ordinary 110 a.c. 60-cycle circuit. By means of a transformer, together with suitable spark gap and condenser, the voltage was stepped up to 250,000 and produced a spark about two feet long. Although the coil is surrounded by a steel cage, it is almost absolutely harmless, as the extremely high frequency of the current makes it impossible to cause injury. However, a screen cage was used.

Space-Saving Radiator

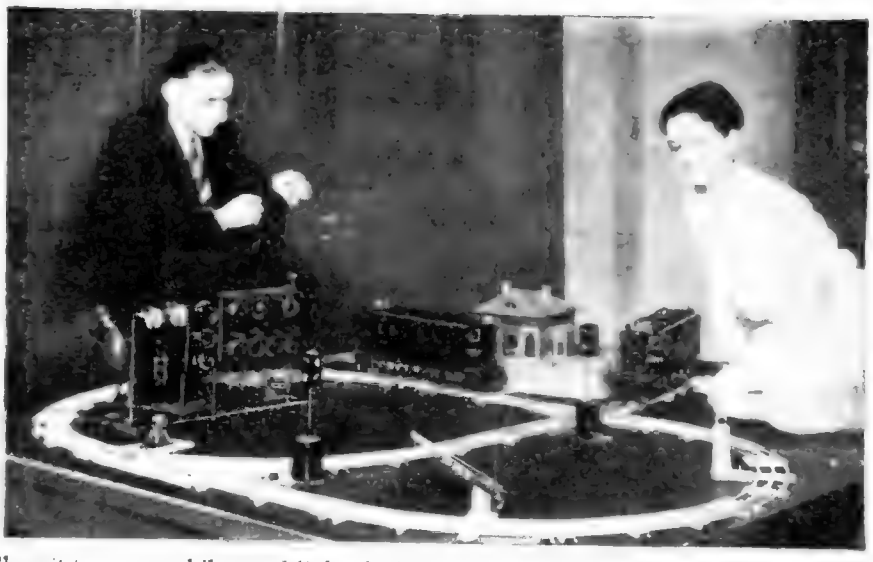
A NEW radiator of compact design and desirable efficiency has recently been introduced. It consists of a number of copper plates secured to the steam pipe, which runs lengthwise about five inches from the floor. As shown in the accompanying drawings, the radiator is compact and



may be covered very easily with the wire cage, so that it does not interefere with the scheme of the room. As copper is a very efficient radiator of heat, when welded to the steam pipe it distributes the heat very quickly, and thus insures maximum efficiency.

No Wrecks
on This Railroad

WESTINGHOUSE engineers recently demonstrated a new automatic railway device at the recent Canadian National Exposition at Toronto, Canada. A miniature railway with trains which stopped, started, and switched without human aid or interference was demonstrated as a suggestion of the railway of the future. The entire manner of control is centered in a panel of relays, time element relay, meters, and a circuit-breaker. There is also included a load regulator to keep the train speed constant; if one train stops, more current is available for the other. Each train automatically stops and starts at the station, and while it remains at a standstill the other is automatically switched around the station to a different route. As the train approaches a crossing, a green light will allow it to cross, while a red light, flashing in the opposite direction, will stop the other oncoming train until the first one passes. The track is laid out in a block system; so that if the train following the first one should increase speed and gain, it is automatically stopped to avoid collision and rear-end crashes.



Above is the miniature railway showing control board and track lay-out, with trains crossing in path of each other.

What Boy Chemists Did

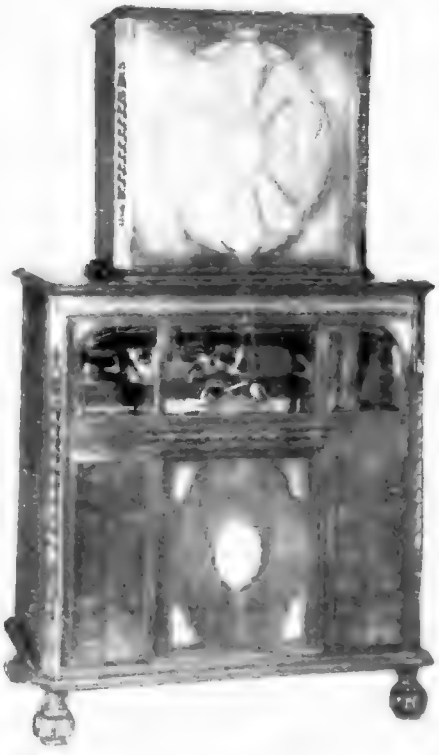
EDWIN ISRAELS, 18, and William Chudnowsky, 19, are shown here experimenting with microscopic slides in the home-made laboratory which they built, together with three other boys, in the backyard of the Israel home, Middle

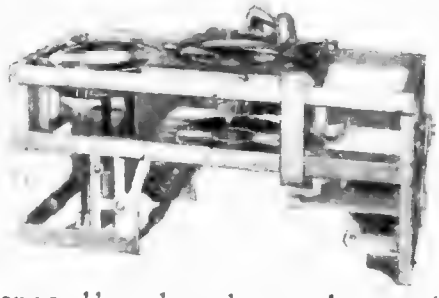
Village, New York. The boys, all of high-school age, use this twelve-by-fifteen-foot shack for their experimenting, and have tackled many current problems of science in this crude workshop, mostly in biology and chemistry.

Have You Heard This One?

Here's Something New in Phonographs

A NEW model phonograph featuring a new departure in automatic record-changing has been put on the market by the Capehart Company. In some models the reproducing is augmented by three-stage amplification and dynamic speaker, which makes it feasible for outdoor entertainment. The records are enclosed in cabinets on either side of the turntable and lifted by means of arms to the turntable and the tone-arm is lowered—all automatically.





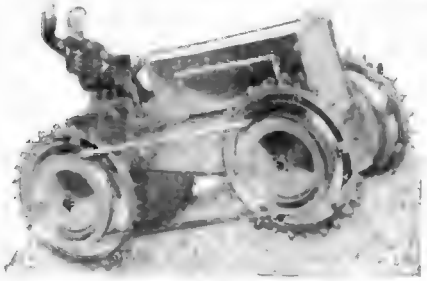
The main advantage of this instrument seems to be its adaptability to any problem where phonographs are to be used. The instrument is supplied with loud speaker built in cabinet or with external speaker, and this makes its use possible for both home and theatre. It is also interesting from the commercial point of view, for it may be adapted to coin-box control, and thus solves the problem of musical entertainment for the small confectionery shop-owner or for the proprietor of the small dance hall. It reprodnces very well.

Tractor

This midget, but powerful, spring-operated tractor will irresistibly push its way over steep obstacles due to all four rubber-studded wheels being connected to the "power plant." The tractor is provided with a brake and a special device for producing a slow, steady motion. It will climb over mountains of books.

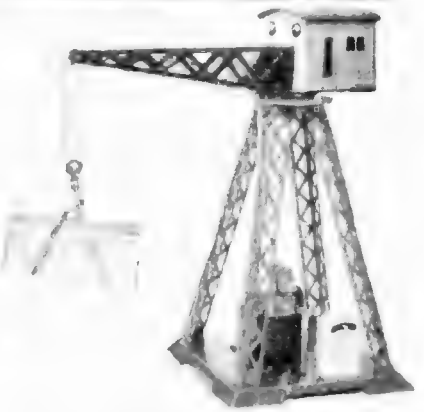
Airport Construction Set

Complete flying fields—with hangars, mooring masts, landing-field lights, revolving beacons and searchlights operated by hand-cranks, to say nothing of Zeppelins, U. S. Navy airships and blimps as well as monoplanes, biplanes, amphibians and seaplanes, ranging in style from the "Spirit of St. Louis" to huge four-motored transports—can be constructed from metal aircraft construction sets.



Machine Gun

The bullets are fed by gravity from a magazine. Rapidity of fire depends upon the individual.

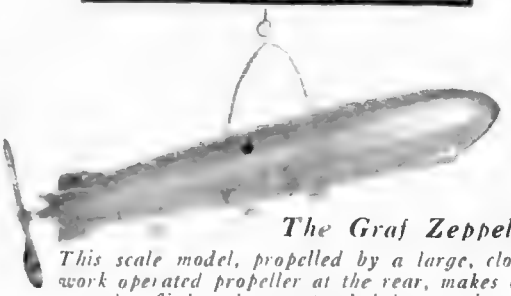


Electrical Crane

This toy, powerful enough to lift any toy engine or car, is controlled by two gear-shift levers, start-stop-reverse, double clutch and worm gear.

Miniature Anti-Aircraft Gun

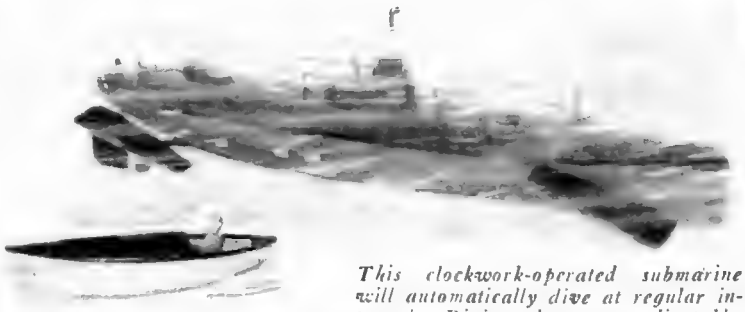
This realistic model shoots rubber pellets propelled by the explosion of small paper caps. It is elevated and revolved for directional sighting by hand wheels.



The Graf Zeppelin

This scale model, propelled by a large, clockwork operated propeller at the rear, makes circular flight when suspended by a string.

Automatic Diving Submarine



This clockwork-operated submarine will automatically dive at regular intervals. Diving planes are adjustable.

Self-Playing Sax

There's no need of practice to play this instrument, which operates by means of special paper music rolls turned by a hand-crank, the air being produced by "lung power."

Motorboat

A small pellet of solid alcohol will keep this boat going for an hour.

Room Equipment

Miniature rooms, two of which are illustrated, are completely equipped with metal household furnishings.

(Names of manufacturers furnished on request)

Novel Time *and*

Vegetable Slicer

TO slice vegetables with this article a rapidly moving disk with knives is rotated by turning the handle. Vegetables are inserted into a suitable hopper, as the photo shows. The article may be clamped to the table.—*J. W. V. S.*

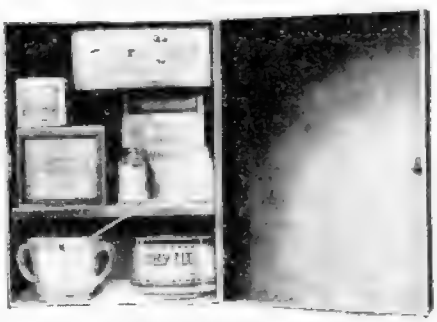
Powerful Midget Binocular and Sport Glass

THIS photograph shows a new sport glass and alongside of it a midget binocular being held in the hand of its owner. The latter glass is five power, can be carried in the vest pocket and weighs only five ounces. It contains 10 lenses and 4 prisms. Being made of a new composition, its price is considerably lower than that of a metal binocular. It is greatly in demand by explorers where a good light glass is required. The small sport glass is noted

Photo courtesy Mirakel Optical Co.

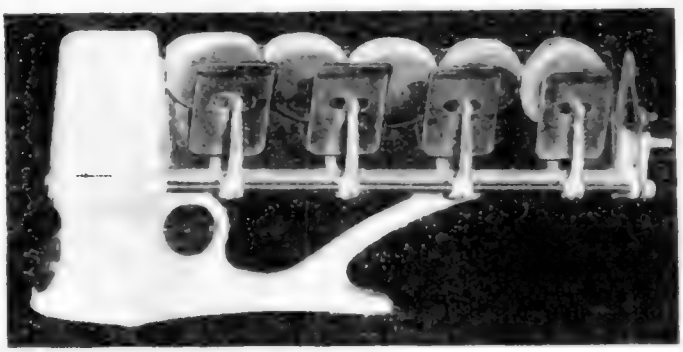
for its enormous field of view, which is equivalent to that of the unaided eye. Were it not that everything appears to be closer, one would little realize that he were looking through a glass.

Preventing Dampness in the Food Cabinet



DAMPNESS, that distressing factor that causes sugar and salt to cake and destroys the crispness of crackers, can be eliminated by using a can containing a chemical which has affinity for water. This product also prevents rusting of tools in a cabinet.

Machine to Toast Buns



BUN sandwiches have always been popular at country fairs and seaside resorts. Then along came the toasted sandwich and detracted somewhat from the bun sandwich in point of popularity. Not to be outdone, an enterprising American manufacturer decided that as long as the public liked toasted sandwiches and buns, he would build a machine to toast the bun. We here see the result of his efforts. This mechanism consumes only 375 watts, hence can be plugged into any outlet socket. It toasts from 5 to 10 buns or 8 slices of bread in 45 seconds.

Combination Vacuum Cleaner, Blower and Sprayer

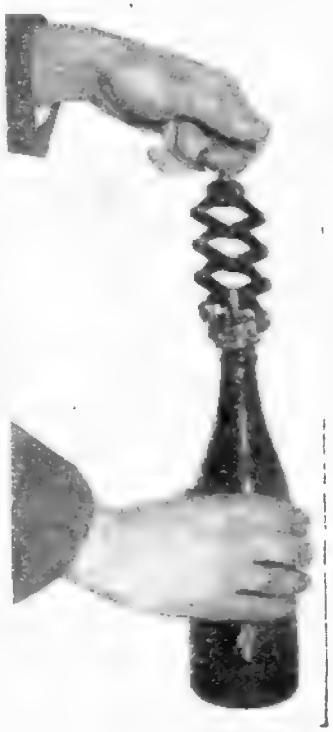
THIS article is a portable vacuum cleaner and blower that can be carried in the hand. It comes equipped with regular suction attachments and with nozzles that are interchangeable on either the suction or the blower side. An oversize motor drives the blower and gives a velocity of air of 286 feet per second. This air can be used for blowing the dust from line shafts, machinery, electric motors and generators, or can be used in a paint sprayer attachment.

Cap Lifter

THIS milk bottle cap lifter is so constructed that when it is applied to the top of the cap, a tongue enters the pasteboard covering. By pressing the lever down, the paper cap is automatically lifted, and when it is again released, the cap automatically closes. The device can be easily transferred from one bottle to another. The illustrations show this cap in both positions, namely the closed and open position. Milk is being poured from the bottle, with cap in the latter position.

Cork Screw With Levers

THIS cork screw is quite unique in that it can be made to exert a pull on the cork of more than 200 pounds. The screw portion is first inserted into the cork, then the bottle grasped and the handle is gently pulled. This causes a ring to tighten around the neck of the bottle, pushing the bottle downwardly while at the same time the cork screw is lifted.—*J. W. V. S.*



(Names and addresses of manufacturers furnished upon request.)

Money Savers

Automatic Siphon Separates Cream from Milk

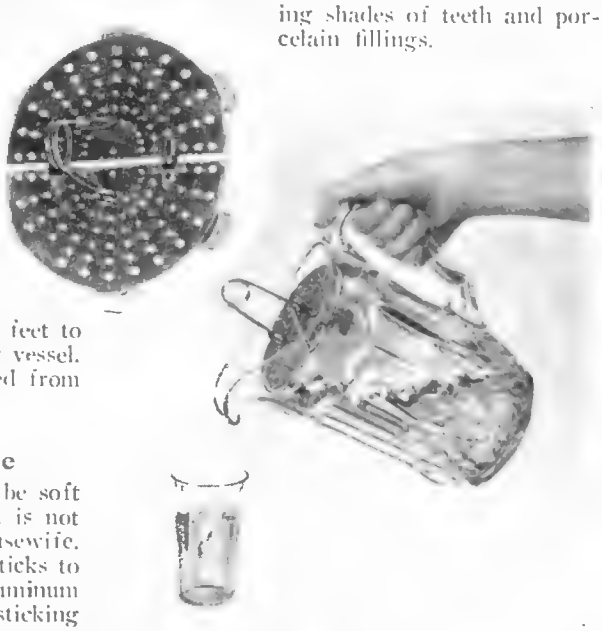
THE automatic siphon here shown, when plunged into a bottle of milk, immediately draws off the cream and then stops operating. Air is confined in the lower portion of the tube, and this air rises, lifting any fluid which has entered the notch and causes the siphon to start. The siphon automatically stops as soon as the predetermined depth of the liquid has been reached.—*J. A. Brandon.*

Shadowless Light

DENTISTS and surgeons have found that a new light, the invention of Dr. Leon Lazar, fills a long-felt need for proper illumination without shadows. Three concentrated filament lamps are contained in three separate projectors which are mounted in a suitable holder. By manipulating but one handle, the beams of light can be focused or directed through gears to cover a spot of any diameter. The angle of tilt is also adjusted by this single handle. For dental work, color filters aid in matching shades of teeth and porcelain fillings.

Ice Retainer

THE interesting article shown at the right is so made that it can be inserted into the mouth of a pitcher. The two sections are pressed together and then released. The spring handle pushes them apart and causes the rubber-covered feet to grip the sides of the confining vessel. Ice and fruit pits are prevented from being poured into the glass.



Ball for Cooking Rice

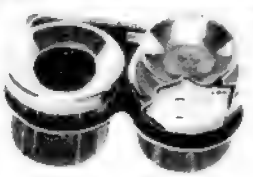
RICE, when cooked, should be soft and fluffy, but this result is not always obtained by the housewife. The rice frequently burns or sticks to the pot. If cooked in the aluminum rice ball illustrated at the left, sticking is prevented. The rice is then fluffy and soft throughout. When cooking is completed, the ball is lifted out of the pot and due to the perforations, the rice drains quickly. The catch is then unfastened, the halves of the ball separated, and the rice is ready to serve.—*J. W. V. S.*

A Pin in a Second

DO you ever find that you need a pin in a hurry? With this device you just press down on the top and presto—a pin appears through a little hole in the top, head up and ready for use. This holder comes in a variety of color combinations and will hold 200 pins at one time. The construction is so arranged that but one pin can be ejected, and there is no possibility of jamming.—*J. W. V. S.*

Cigarette Extinguisher and Ash Receiver

THE unique combination cigarette extinguisher and ash receiver here illustrated can be used on automobiles or on airplanes to great advantage. As will be observed, in the cutaway photo, the item on the right contains water in a well. When the cigarette is touched to the top of the extinguishing well, a sufficient amount of moisture is there present to put out the light. After this, the cigarette can be dropped into the second well, which serves as an ash receiver. To fill up the water-containing portion, the entire object is removed and held beneath the surface. The top is then pumped up and down several times, completely filling this part of the device. Because of the small apertures in the top, the water evaporates slowly.



SPACE, TIME *and* RELATIVITY

Is Space Curved?

By Donald H. Menzel, Ph.D.
Lick Observatory, Mount Hamilton, Calif.

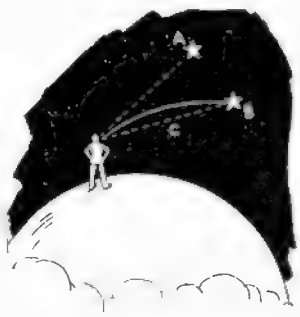


Fig. 5. The star, which appears to be at A is actually located at B.

Light travels in a long curve. There is no better measuring rod than light rays, but we cannot make these behave according to Euclidean standards. We develop a theory from a postulate that cannot be proved. Nowhere in nature can we find a straight line

The Trialogue Continued

LAYMAN—Perhaps you will be good enough to explain what you mean by curved space.

PHYSICIST—That phrase has bothered me, too. How

Fig. 1. That parallel postulate! Actually, two lines are never parallel, owing to different curvatures at infinity.

can space, which is nothing, have any curvature?

RELATIVIST—I am glad you asked that question, since I intended to discuss it with you today.

In the first place, I do not entirely agree with you that space is nothing—at least in the sense employed by relativists. We are concerned, not with truly empty space, but with space that is being measured—in other words,

Fig. 2. Three triangles drawn on the earth's curved surface. The sum of the angles is obviously greater than 180 degrees.

space that contains some sort of measuring rod—a yardstick or a light beam, for example. When I speak of curved space, I am, a little more accurately, referring to the curvature of my measuring rod.

P.—Aren't you getting a bit metaphysical? Why not take the trouble to provide a perfectly *straight* measuring rod?

R.—You forget that it is impossible to define a straight line. Our problem is not the exploration of space with hypothetical Euclidean (*i. e.*, straight) measuring rods, but

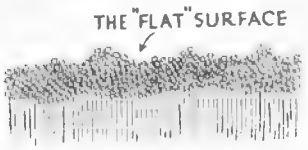


Fig. 3. A flat surface is made up of many atoms, indicated as circles. Even the flattest possible area is pitted with the spaces between the atoms.

how do actual rods behave when they are used to survey space. There is nothing metaphysical about that. The question is eminently a practical one. We should not try to fit any given type of geometry to the world, but determine what is the natural geometry that governs it. By the way, what do you recall of your geometry?

L.—I've forgotten most of mine, I fear. Let's see. A straight line is the shortest distance between two points. Through a given point only one line can be drawn, parallel to a given line . . .

R.—That's enough for a start. How do you know that only one line can be drawn, as you say, parallel to a given line? (Figure 1.)

Fig. 4. A light ray is not a straight line, but is full of waves.

L.—Come to think of it, those statements are really postulates. We assume them.

R.—Why do you assume them?

L.—Because they are obviously correct.

R.—If they are obvious, why do you not prove them outright; otherwise

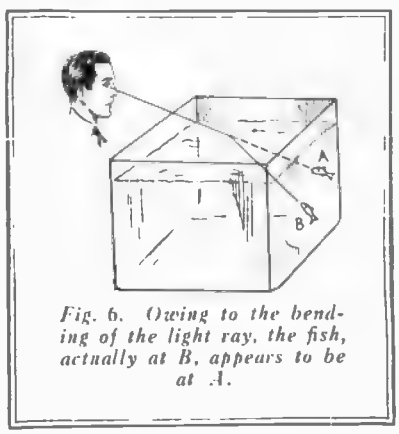


Fig. 6. Owing to the bending of the light ray, the fish, actually at B, appears to be at A.

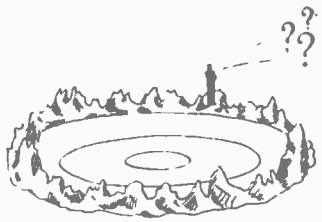


Fig. 8. Columbus could have said, "There is a definite limit to the size of a circle that can be drawn on the earth's surface." No circle exists beyond that circle.

your system of geometry may be open to question?

L.—If I recall correctly, no one has ever been able to prove them—but they seem so obvious that proof is really unnecessary.

R.—Does it not strike you as rather queer that something so "obvious" cannot be proved? The greatest mathematicians of all times have devoted their efforts to the problem, without success. Riemann and Minkowski, the most illustrious of these geometers, finally came to the conclusion that those postulates are entirely unnecessary to the development of geometry. Assume them to be true and you obtain your familiar Euclidean geometry. Reject them and your geometry will be very changed—straight lines swing into long

(*Continued on page* 852)

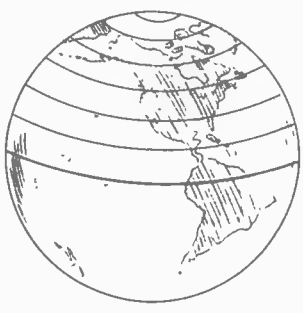


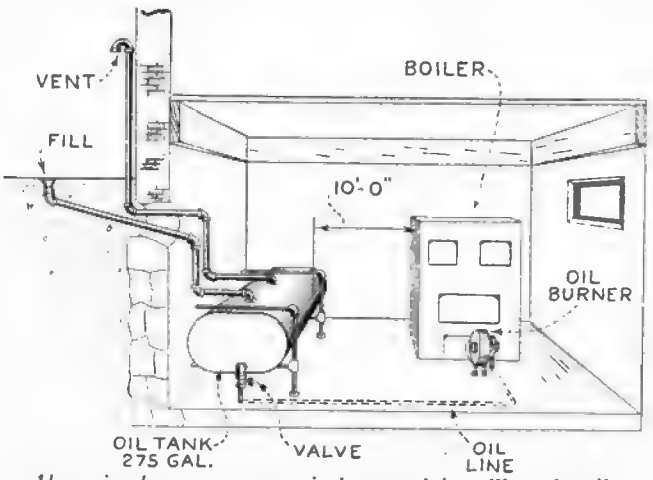
Fig. 9. The actual state of affairs. The statement that the 96th circle is the largest that can be drawn in our universe no more implies a sharp boundary to space that the statement that the equator is the greatest circle that can be drawn on the earth implies an end to the earth's surface.

How to Select an Oil Burner

The Average Cost of Oil-Burners, Size of Oil Tank, and Other Important Advice

By Harry F. Tapp

Oil Burner Specialist; Technologist, The American Oil Burner Association

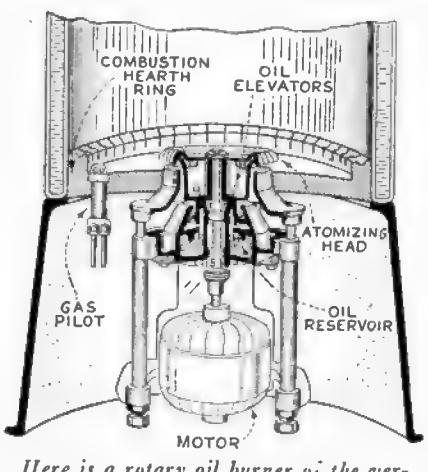


Above is shown an economical way of installing the oil tank in the cellar; approved by the Fire Underwriters.

THE purpose of an oil burner is, primarily, to permit liquid fuel to be burned in a furnace, originally designed for coal or some other fuel, and is really an accessory to the heating plant. Therefore, it is important that serious consideration be given to the entire heating system. It makes no difference whether it is a steam, vapor, hot water or warm air system; as long as it is well designed and in good condition an oil burner can be satisfactorily applied. But, if your present heating plant is not giving satisfaction, if some room is not heating properly, or any other ills of a sick heating system are apparent, the oil burner cannot be expected to eliminate them. It is true, some improvement is usually experienced, but it is not a "cure-all."

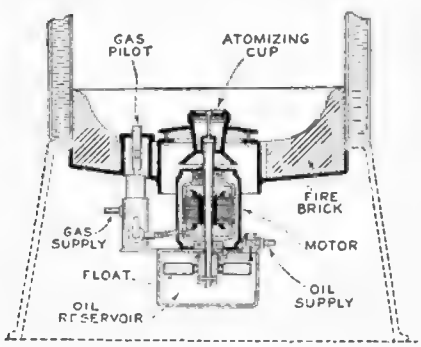
It is for this reason, high class oil heating dealers have a heating engineer on their staff and make a survey of every heating plant before they make the installation. When the engineer inspects your home, give him all the information you have freely. Where the difficulty is due to some minor fault he will locate it and, if possible, suggest a remedy. If the fault is a major one, he will recommend against making the installation until the necessary changes are made.

In an old heating plant the boiler or furnace will often be either obsolete or worn out, necessitating its being replaced. In this case, it is recommended that a boiler especially designed for oil burning be used, as it will prove considerably more efficient and economical than one designed for solid fuel. In a warm-air system, a welded steel furnace is more desirable than the usual cast-iron sectional type. It is also recommended that a circulating fan be installed in the cold air duct as it provides positive circulation of the warm air, resulting in more uniform temperature throughout the house, and it will usually increase the efficiency of the system with a resulting saving in fuel.



Here is a rotary oil burner of the vertical type utilizing the atomizing principle for feeding the oil.

Another point to keep in mind is the basement. In part II, of this series, suggestions were made as to the possible uses for this part of the home. While it is not important that you make all your planned improvements at once, it is well to give this matter some thought before the installation is made. For example: If the furnace room is small and you desire to install a laundry, it is possible that an *inside type* of burner would be desirable as this type of burner requires less floor space. If, on the other hand, you prefer the other type of burner, it may be possible to install it to fire from the side, or even the back of the boiler. If necessary, the furnace can be turned to meet your requirements.



At left is shown a cross-section of the atomization oil burner in the vertical position.

In the past there has been considerable confusion in connection with the designation of various grades of oil fuel by the use of their gravity number and various trade names such as Furnace oil, domestic fuel oil, a light oil and heavy oil. This confusion has been greatly eliminated by the recent adoption of uniform oil specifications of the American Oil Burner Association and the Commercial Standard Unit of the U. S. Bureau of Standards, which classify the grades by numbers 1, 2, 3, 4, 5 and 6—number 1 oil being a light volatile fuel, number 2 a medium grade and number 3 a heavy grade. These three oils are all comparatively light when compared with the oils number 4, 5 and 6, which are used in large commercial and industrial oil burning installations.

There are all kinds of claims made by various salesmen as to the advantages and disadvantages of the various grades. As a matter of fact, they can all be used with entirely satisfactory results if the equipment is correctly designed. The lighter oil (number 1) has less BTU's or heat per gallon than the heavy oil (number 3) but the difference is so small that the most important factor is the price. A burner designed for a number 3 oil may also use oils number 2 or number 1.

Today, with the large number of fuel oil distributors, it is possible to obtain suitable oils in nearly every section of the country. An important development in this respect is the conversion of coal dealers to fuel dealers. It is, however, well to make a check on the available grades of oil in your immediate vicinity.

What Size Storage Tank?

IT is important to decide upon the size of storage tank when making up your plans for the installation of a burner. If your house is small and regular oil deliveries are assured, a basement tank of 275 gallon capacity makes a very desirable installation and at the same time reduces the installation cost. In some localities it is permissible to install two 275 gallon tanks in the basement.

This type of installation gives adequate storage capacity for almost any residence. Where this type of installation is not permitted and where oil deliveries are likely to be slow, the underground storage tank should be installed.

The usual size of underground storage tanks is 1100 gallons capacity, although many (*Continued on page 832*)

Motor Hints

By George A. Luers

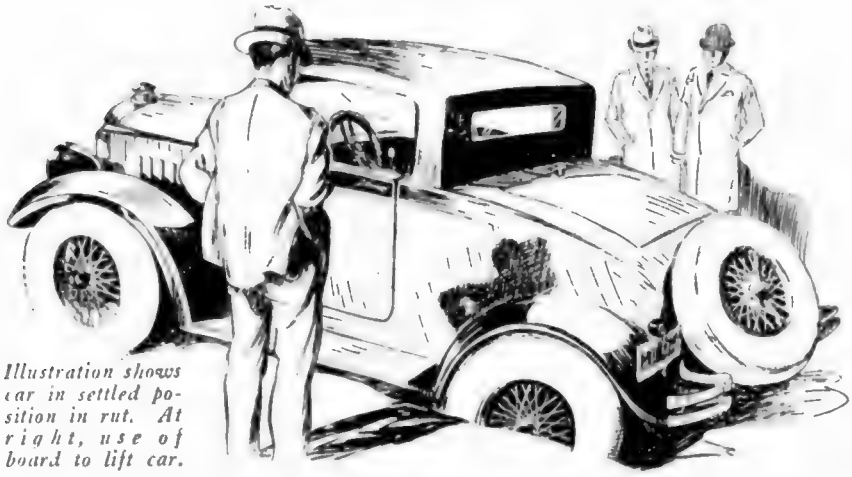
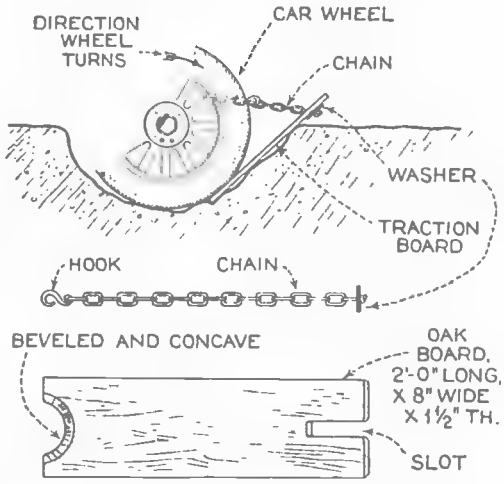


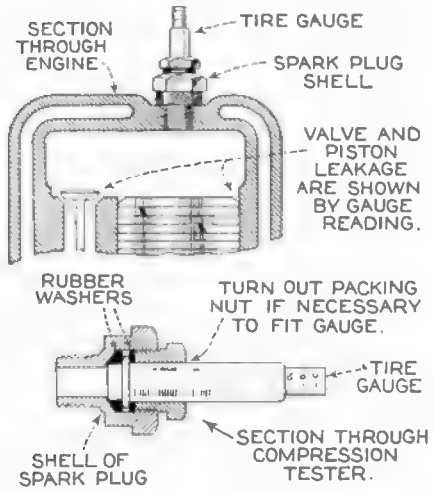
Illustration shows car in settled position in rut. At right, use of board to lift car.



How to Get Out of Deep Mud or Snow

TO lift the rear wheels of your car from a ditch, the illustrated wooden lifts will prove an invaluable aid. Two are required. The boards should be of oak, about 1¼ by 8 inches and 2 feet long. A notch is made at one end to accommodate a chain; the other end is made concave and beveled to provide an easy start for the wheel. Two pieces of chain, one for each wheel, are used, with a hook on one end and a washer on the other. The chain slips free from the board as the wheel rolls off it.

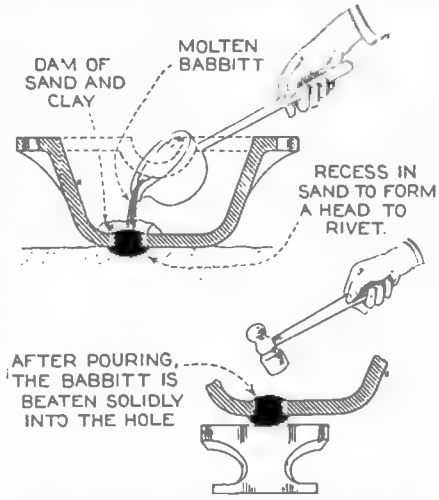
Test for Lost Compression


SECTION THROUGH ENGINE
TIRE GAUGE
SPARK PLUG SHELL
VALVE AND PISTON LEAKAGE ARE SHOWN BY GAUGE READING.
RUBBER WASHERS
TURN OUT PACKING NUT IF NECESSARY TO FIT GAUGE.
TIRE GAUGE
SHELL OF SPARK PLUG
SECTION THROUGH COMPRESSION TESTER.

Above is sectional view of cylinder, showing spark plug replaced by tire gauge.

THE car owner finds it difficult to determine if cylinder leakage exists by turning the motor over by hand. A simple and yet effective means of determining this leakage is with a tester, made from a tire gauge and a spark plug shell, as illustrated. In fitting the tire gauge, it may be found necessary to turn some metal out of the packing nut of the plug. Fit rubber washers around the flange of the gauge to make it a tight fit in the shell. The compression may be found easily by this means.

How to Plug Holes with Babbitt


DAM OF SAND AND CLAY
MOLTEN BABBITT
RECESS IN SAND TO FORM A HEAD TO RIVET.
AFTER POURING, THE BABBITT IS BEATEN SOLIDLY INTO THE HOLE

Using babbitt metal in plugging aluminum.

THE use of babbitt metal, as shown above, is very satisfactory. The hole in the casting is placed above a recess in dry sand. Clay and sand are used to form a dam and the molten babbitt is poured into the hole. On cooling, the metal is hammered.

Clean Way to Fill Grease Gun

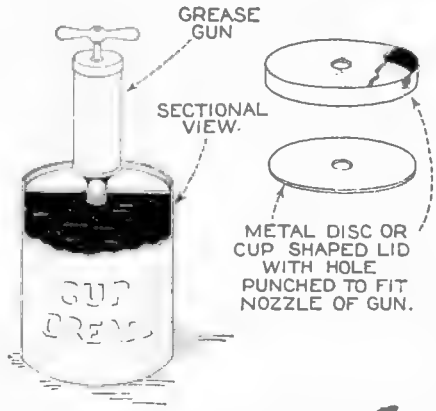


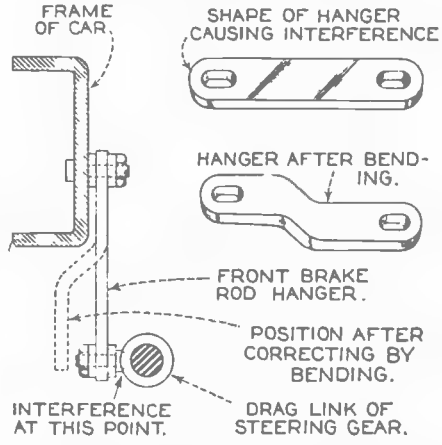
Illustration shows way to fill grease gun.

THE filling of the grease gun is usually a messy procedure. The idea of one car owner, to avoid this slow and disagreeable process, is illustrated here.

A metal disc, made quickly from a can lid, or a large washer with a hole to fit over the nozzle end of the gun is all that is required for better operation.

Place this down against the grease, press the gun into the opening and, while pulling back the plunger, continue to keep the disc pressed into the grease. The gun will be full in a single stroke without air in the barrel. The lid of the grease tin can be trimmed down and a hole can be made in it for this use.

Overcoming Defects of Four-Wheel Brakes

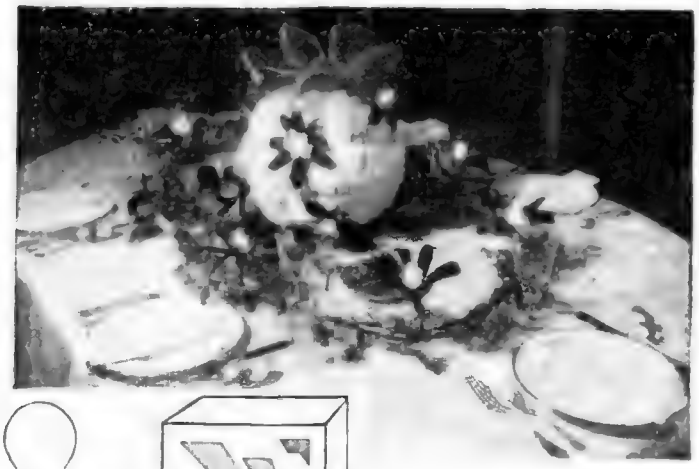

FRAME OF CAR
SHAPE OF HANGER CAUSING INTERFERENCE
HANGER AFTER BENDING.
FRONT BRAKE ROD HANGER.
POSITION AFTER CORRECTING BY BENDING.
INTERFERENCE AT THIS POINT.
DRAG LINK OF STEERING GEAR.

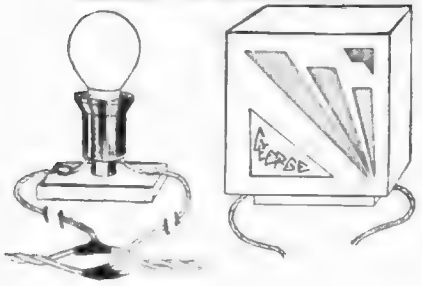
How front brake rod hanger was bent to clear brake action.

THE owner of a light, popular type of four-wheel brake car noted when making a sharp right turn that the left front wheel would lock and cause the car to come to a stop. It was found, after many trips to the service station and numerous brake adjustments, that the steering drag link was located close to the brake rod of the left front wheel. The hanger was positioned, so that the drag link caught into the hanger and applied the brake. The owner found that the trouble was easily corrected by bending the hanger away from the drag link.

You Can Make These Illuminated Table Decorations

By Josef W. Von Stein



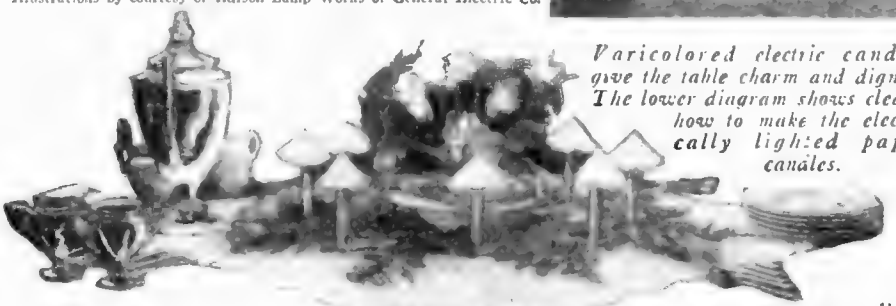


Details of wiring one type of place cards.

The snowball and poinsettia place cards grace this Christmas table with a touch of cheerful holiday color.

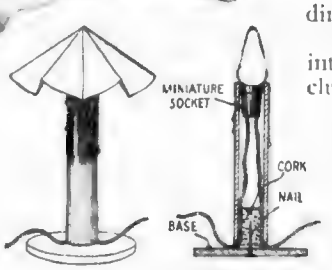
Illustrations by courtesy of Edison Lamp Works of General Electric Co.

Lighted balloons, especially if of a unique animal type, will delight the youngsters or serve as basic decorations for an indoor garden party.



Varicolored electric candles give the table charm and dignity. The lower diagram shows clearly how to make the electrically lighted paper candles.

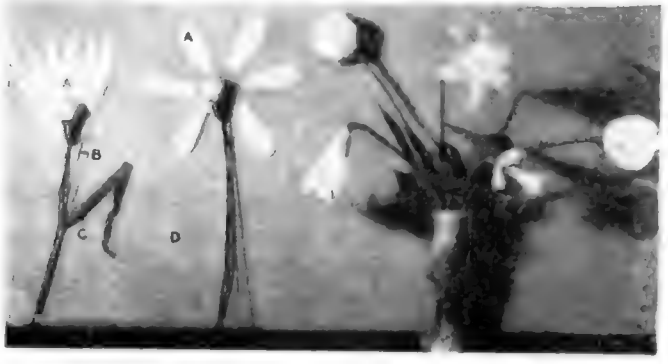
A SURPRISINGLY large variety of decorative lighting effects can be easily obtained, with a little ingenuity, from materials usually already in the home. Lighted crêpe paper flowers, lighted character dolls, place cards of individual creation, favors and novelties of all kinds can be made by placing lamps in already familiar paper forms. Their use is not limited to seasonal and holiday parties, because general functions such as luncheons, formal dinners, bridges, receptions and the like can be made much more colorful and interesting with them in service. This festive lighting should not be limited to spelling the Yuletide greeting, but can be extended much further and made the keynote or central feature of the party, dance, dinner, wedding and the banquet.



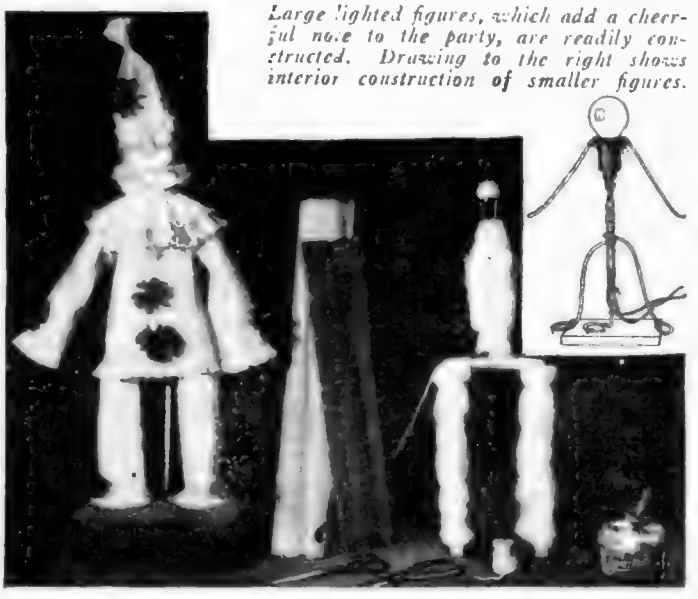
Roughly speaking, the materials used fall into two classes—the lighting equipment including lamps, reflectors and wiring and the decorative paper accessories.

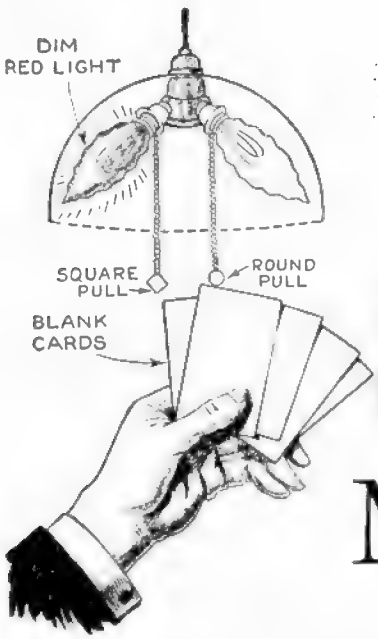
The larger lamps—25 to 100-watt sizes—are used only to a limited extent, such as producing of miniature flood-lighting effects on the table or in the room. Both white and colored lamps are used. In instances where the decoration is elaborate, metal reflectors, (*Continued on page* 830)

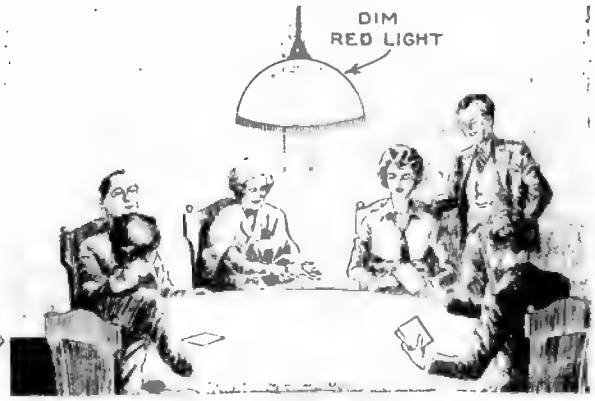
Method of making lighted paper flowers: A, paper flower petals; B, supporting wire for stem; C, paper binding together electric wires and supporting wire; D, short lengths of spool wire.

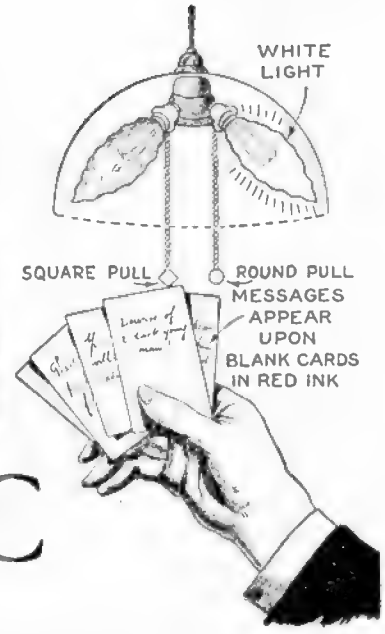


Large lighted figures, which add a cheerful note to the party, are readily constructed. Drawing to the right shows interior construction of smaller figures.









MAGIC

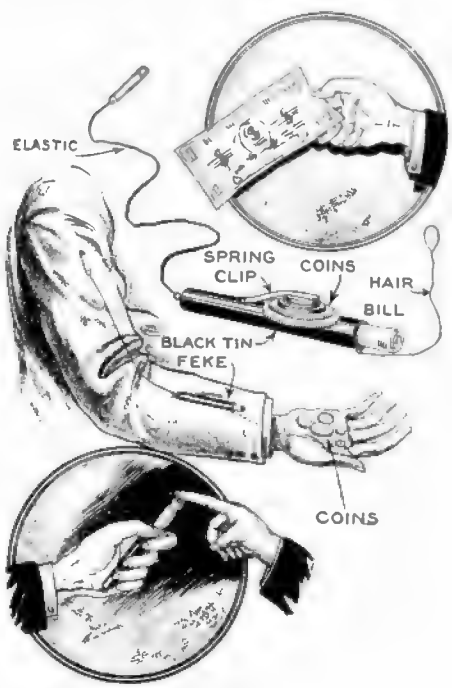
A number of cards are examined under a dim red light and are found to be quite unprepared. The room is darkened for an instant and then the white light is turned on, revealing lengthy messages on the cards.

By Hunninger

The Change-Maker

THIS is an absolutely new effect in conjuring which produces the appearance of being a difficult sleight-of-hand trick. The hands are exhibited empty, both back and front. The magician requests the loan of a dollar bill, which he rolls up into a small tube-like form. He then pushes this into the palm of his hand and on opening the palm we find the bill has been transformed into the correct change of a dollar.

The secret: A small tubular tin feke is provided with a spring clip to hold the coins. This is attached to the sleeve with an elastic band, as the diagram indicates. The opposite end of the tin feke is provided with a hair which loops around the index finger. The hair helps the magician pull the tin feke into the palm of his hand, whereupon he inserts the dollar bill, removes the coins and lets the feke go.



No. 77 of a Series

Spirit Messages De Luxe

THIS is a new and novel method for presenting a striking and uncanny spirit seance. A group of spectators are seated around the magician's table, who in this case assumes the rôle of a spirit medium. The room is dimly lighted by a red light. The magician presents a great many blank cards about the size of ordinary visiting cards. The spectators are requested to take one or more and place them down upon the table and cover them with the palms of their hands. The medium states that he has an instantaneously writing spirit that will produce lengthy messages upon each one of the cards and on both sides thereof in only a fraction of a second. For this purpose the spirit requires total darkness. Having thus explained the situation, the magician turns out the light and a second later pulls the chain of the socket, turning the full glare of the white light into the room. The cards, when examined, contain mysterious messages, boldly written in red color.

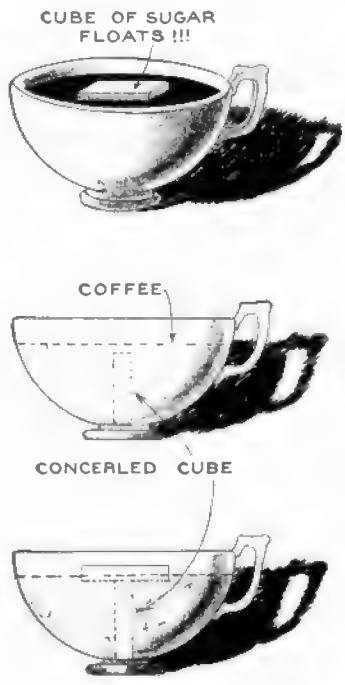
The secret: The cards have all been previously prepared by writing messages upon them, using a thin camels hair brush and a red water color paint. The paint must be carefully mixed and this should preferably be done under the same red light which is to be used in the seance. It will be found that a red ink can be prepared which will be absolutely invisible when illuminated by a red light. The white cards also appear red when so illuminated and hence the writing cannot be seen. Even if the cards are carefully examined the spectators will not know that the messages have already been written upon them. It is only when a white light or some other colored light is turned on that the writing appears visible.

(*Many other variations of this trick will readily suggest themselves to the amateur magic worker. If you have not mastered a few of the pocket tricks described here each month, you don't know what fun you are missing.*—EDITOR.)

Conjuring With Sweetness

HERE is an after-dinner trick which requires no preparation. At the end of a hearty meal the wizard sips a little of his black coffee, containing neither sugar nor milk. Reaching into the sugar bowl, he removes a cube of sugar, carefully places it upon the surface of the coffee in his cup and causes it to mysteriously remain afloat. At the word of command the sugar disappears. The magician adds milk and cream, stirs the coffee and drinks it, proving unpreparedness.

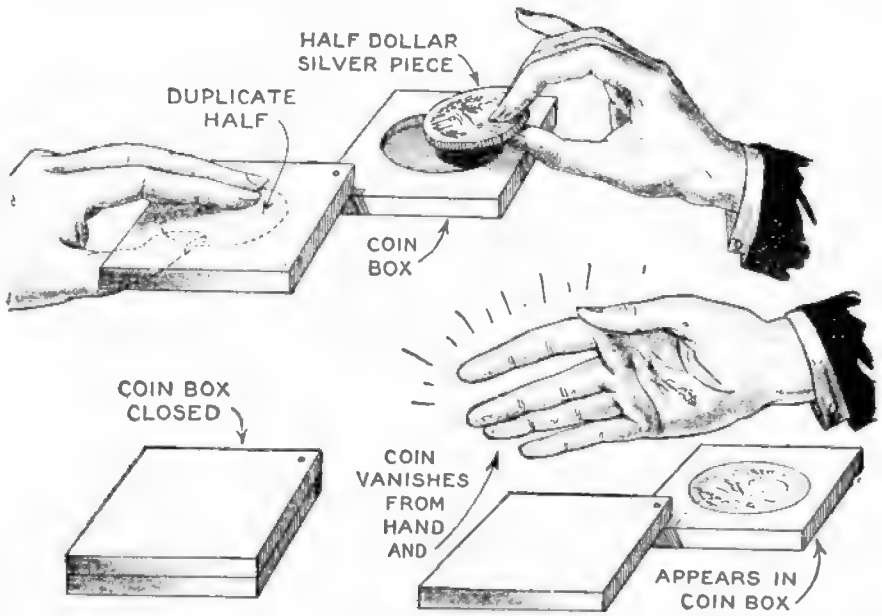
The secret: The magician actually takes two lumps of sugar, but inserts one of them in an upright position as the diagram shows. To all appearances one cube remains afloat, but disappears as the one beneath it melts.



Ultra Coin Box

TRICKS wherein coins are employed are ever popular with the modern magician. Many times an occasion presents itself wherein the wizard requires some novel way for secretly substituting a borrowed coin for one of his own. This novel piece of apparatus will be found quite useful on such occasions.

Half-dollar sized coins are most commonly used by sleight-of-hand experts. They are sufficiently large to be conveniently seen, and likewise prove a suitable size for handling. A half-dollar, after being borrowed from some spectator, is marked for identification. The magician illustrates that the coin will fit conveniently into a circular recess prepared for it, in a small square box, designed as illustrated. The coin is then removed, and the lid of the box pushed into position. The box is placed in full view upon a table. The pocket piece is now vanished by any method the performer may desire, and upon opening the box it is discovered to have mysteriously found its way back again and is identified by its mark.



The secret: The box really has two cavities large enough to hold a coin. One is in the lower section, the other in the upper. The two sections are held together by a single screw acting as a pivot. No matter which way the box is turned, either of the parts will serve. A duplicate half-dollar piece is first concealed in the cover of the box, and is held in place by the thumb. The marked coin is exchanged for this duplicate by secretly turning the box over when illustrating it. Readers will conceive that one coin is always in the box, in spite of the fact that it seems empty. The box may be made of cardboard.

Trophy Cups for Models

Magnificent Cup Given for Approved Models

THE readers of this publication have been clamoring for a return of the Model Department, which has been made famous throughout the country and which has been an incentive to the students of model engineering in all its forms and phases.

The Model Department was started several years ago. At that time the best model submitted during a month was awarded a magnificent cup, handsomely engraved with the words, "Science and Invention Model Trophy." Many contestants found it difficult to get the trophy because of the really excellent models against which they had to compete.

The plan entered upon which will give the makers of good models a better opportunity of winning one of the coveted prizes has been somewhat changed. Now any model accepted by the editors and published in SCIENCE AND INVENTION Magazine will be awarded this beautiful prize.

The cup itself which is given as an award measures 17½ inches over all and weighs nearly five pounds. Like all other fine cups, this one is gold-lined. The cup is further engraved with the model maker's name.

Certain requirements are necessary in order to obtain such a cup. A decision is always based upon, A, the novelty of construction; B, workmanship; C, the operating efficiency of the model as related to the efficiency of the device which the model simulates, and D, the care exercised in design and submitting to us sketches and other details covering the model. All kinds of models may be submitted for examination. They may be working models or not, according to the subject handled. The models may be made of any available material. In all cases the models must be sent to the editors by parcel post, express or freight, prepaid.

Mr. Brown holding one of the Model Trophy Cups, and some excellent models similar to those soon to be available to model enthusiasts.

It is suggested that models made from parts of a construction outfit should not be forwarded. While such a model would not be barred, it must be obvious that many other readers of this publication will also submit a similar article and the editors might frown upon publication. They can get the same material directly from the manufacturers.

So, come on, you fellows who have made models of ships, airplanes, guns, railroad trains, dirigibles, steam engines, submarines and the like. Send your drawings and models to the Editor of the Model Department. If the model is looked upon favorably and it is published, the handsome engraved cup will be your reward for permitting others to duplicate your original design.

The editors prefer in all cases to have the model itself forwarded for inspection, photographing, and checking of dimensions for preparation of drawings, etc.; but where it is impracticable, for one reason or another, to forward the model itself, the builder may submit good photos of the model, together with sketches or drawings, and a photo of the builder himself.

ALL READY, MODEL BUILDERS. LET'S GO!

It does not require any keen sense of observation to readily classify the above scene as a happy family assembled in a cozy corner of their living-room, which, as may be seen, is evenly lighted, with soft shadow effects obtained by the overhead lighting. A glance at Fig. 2, at the left, however, will show that this scene is actually a part of the exterior of a house; Fig. 1.

Inexpensive Home-Movie Sets

By Don Bennett

SEVERAL months ago an article was published in the Home Movies section describing the building of sets and "flats" for the making of interior scenes outdoors.

There are some amateurs, however, who are not mechanically inclined or whose economic strength precludes the investment in materials required for the setting of a fair sized room. To these amateurs, this article is addressed.

Do you have a home or a garage whose exterior is just

Fig. 4.. This attractive "sun-parlor" interior can be readily filmed outdoors, as may be seen in the illustration to the right.

like an interior? Then use it as a setting for your exterior interiors. Figure 1 on this page shows you a happy family group assembled in their living room, Mother sewing while Daddy explains the wonders of an animal book. Notice the nice even lighting, the soft shadows cast by the overhead lighting, the full tones of the faces. Isn't it a homey atmosphere, the cretonne drapes at the windows, the soft picture on the wall, the comfortable chairs and cosy lamp?

Now look at Figure 2. See the much trampled turf in the foreground, the roof of the garage, the open doors at the right. The curtains are on the *outside* of the window and the dark interior gives a perfect night-time effect. You will notice that the room is suggested by a few carefully placed pieces of furniture and wall decorations. Nothing excessive, nothing to give away the trick except the roughness of the carpet and the reflections in the windows and careful direction and camera angle will keep those from being noticeable in the picture.

In your neighborhood there must be a building so fashioned that you can make a similar setting. Do not overdo it, just suggest the interior setting and have your action carry the rest of it. Remember, motion pictures require motion.

In Figure 3 is a simple set that can be built for a few dollars with volunteer labor for the club production. A half dozen pieces of wall board with a door and a window, a few pieces of furniture and some decorations dress the set. Figure 4 shows the view as seen by the camera. The background through the door is perfectly "natural," on a windy day the grasses will ripple in the breeze and the curtains will blow gently (but be sure the window is open so that a breeze from the camera side will not look suspicious).

There are a few things to remember when shooting interiors on exterior sets and probably the most important one is to choose a day when little or no wind is blowing. The next one in importance is to select a day when the light is not too harsh. Hard light will throw hard and deep shadows and thus expose your trickery. A sky slightly overcast will give the soft effect of interior illumination achieved in Fig. 1. Notice the hard shadows in Fig. 4. This picture was made on a bright sunshiny day and the shadows and lighting are hard.

Possibly the easiest and most thrilling picture to make is a "Western." For years they have paid the producers the losses incurred in making the (*Continued on page* 857)

Photos Courtesy Eastman Kodak Co.

Fig. 3. A "sun-parlor" set can be cheaply constructed.

Making SILHOUETTES *Without* SCISSORS

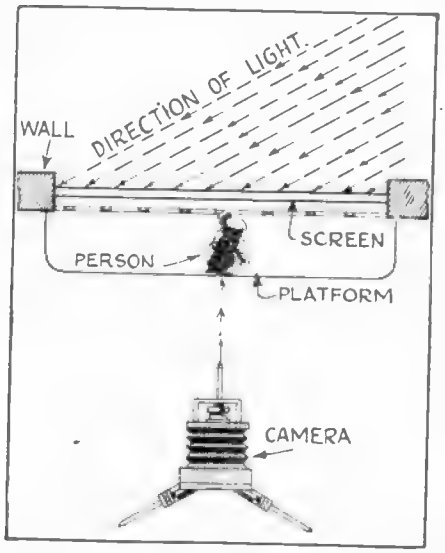
By Utilizing a New Simplified Method of Photography, Anyone Can Produce Beautiful Relief Images

By H. H. Dunn

The pleasing "silhouette," reproduced at the left, was made with the camera and subject shown below. The subject is placed in front of an illuminated screen, with the camera in the position shown.

AN interesting new kind of photography—done as easily with the two-dollar camera in your own home as with the two-hundred-dollar instruments in the studio—has been devised by Otto Dyar, clever young photographer of Hollywood. Most amateurs have been accustomed, in making their pictures, to seek a spot where the sun's light fell from them toward their subjects. By the new method the light must be from behind the person or object to be photographed.

The results are as beautiful as etchings, done in pure black and white, with a wide range of possibilities in halftones through the placing of reflected light from a mirror on any part of the subject. Silhouettes more perfect than any ever cut from black paper with sharp scissors may be made and preserved forever in the negative; portraits as desirable as pen-and-ink drawings may be produced by the careful amateur, and the discovery holds endless possibilities for caricature, with the amiable assistance, of course, of the subject.



Proper position of screen, subject and camera in the making of silhouette photographs by sunlight in the home.

Owners of home motion-picture cameras and projectors may make and enjoy whole reels of these silhouettes, for the idea is as applicable to action pictures as to "stills." One of the large motion-picture corporations is preparing script, costumes and a special company for the production of folk-lore and fairy-tale playlets, in silhouettes, for children. This will be the first work of the kind ever done, and the activities of children in and around the home should be as easy to film in this black-and-white as are those of the stage characters.

Elaborate equipment, with controlled lighting, will be used in making these

(*Continued on page* 836)

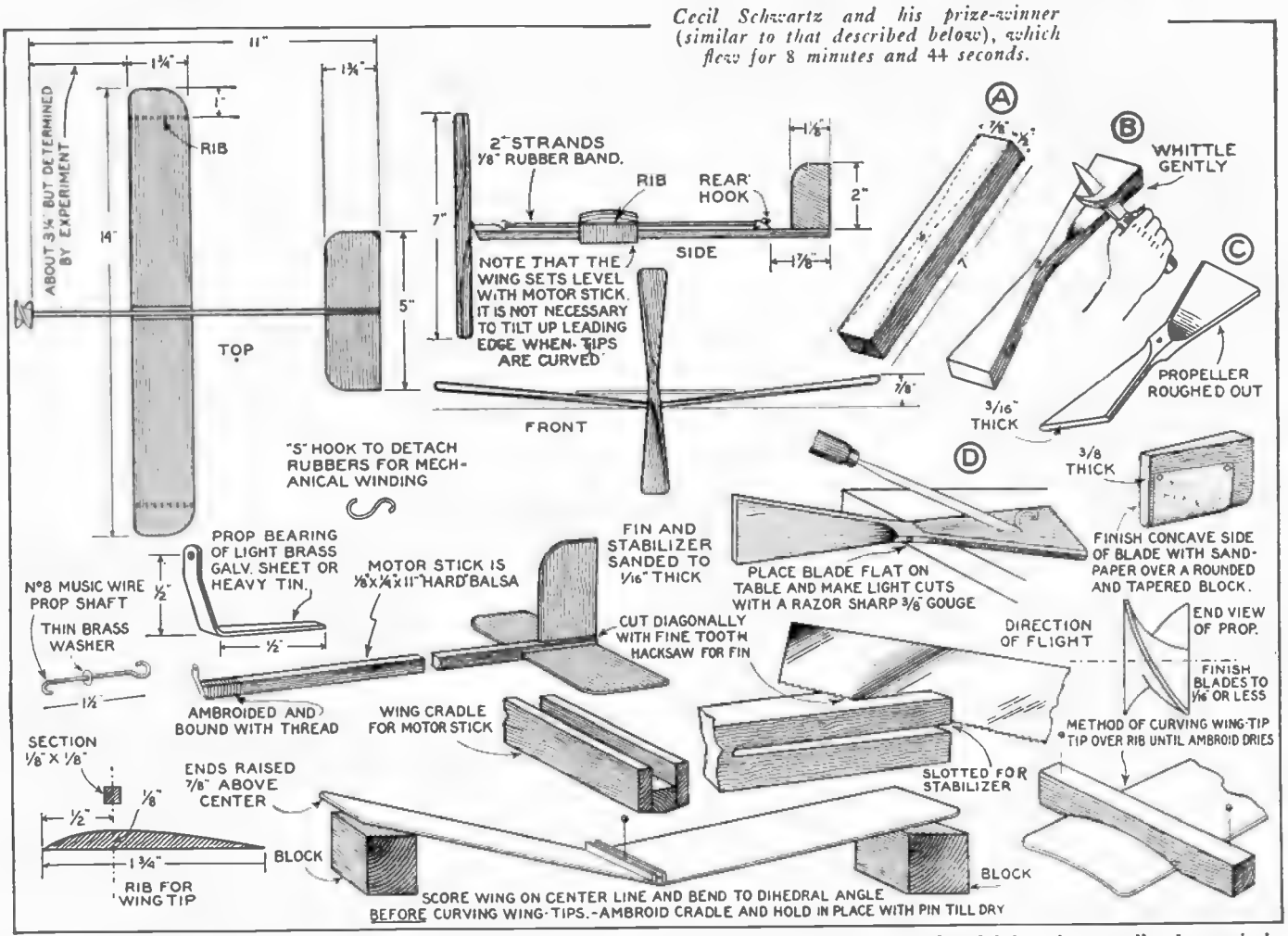
Christmas and other seasonal cards of pleasing appearance frequently have silhouette figures on them. Here is a way to make true silhouettes of your friends and relatives for use on such greeting cards.

How to Build a Record-Winning Plane Model

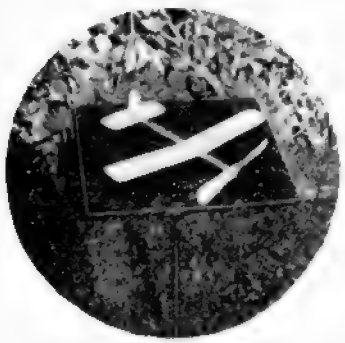
Novel Plane Model Which Is Made of Balsa Wood and Is Extremely Popular With Tyro and Expert Model Builders

By Hi Sibley

Cecil Schwartz and his prize-winner (similar to that described below), which flew for 8 minutes and 44 seconds.



This model plane weighs less than one-quarter of an ounce and will stay in the air until the rubber driving the propeller has entirely spent its force. The sizes of all parts and complete directions for building this balsa tractor plane are given.



Photograph of the all-balsa plane, capable of 200-foot flight.

IF you are good at working with balsa wood, you can make a lively little tractor plane model from these plans. It is constructed entirely of this unusual wood and weighs less than one-fourth of an ounce, and is so light, in fact, that it will stay above ground until the very last turn of the rubber. Its distance depends entirely upon the care with which it is made and your skill in launching. Of course, the adjustment of the wing is everything in even flight, and experiment will determine the best location on the motor stick. Although it shows best performance in indoor work, on still days outside it will fly from 100 to 200 feet, a fair mark for a small plane of this type.

There is considerable variation in balsa wood, and if you have any choice select a clear, straight-grained piece ⅛ in. by ¼ in. by 11 in. of so-called "hard" balsa for the motor stick. Soft balsa will do for ordinary flights, but the rubbers cannot be wound as tightly.

First make the slots for stabilizer and fin. A piece of hacksaw blade with fine teeth is ideal for this purpose. Cut slowly so the slots will be accurately in the middle of the stick. This is important in the stabilizer slot, for if it is not perfectly level the wing will have to be adjusted to counteract it. (*Continued on page* 851)

Mirth-Provoking Stunts for Home Entertainment

Tricks *with a* Phonograph

By Esten Moen

Unusual Experiments for Talking Machine Owners Are Easily Performed

GOOD citizens all, gathere ye unto here, for mutuelle entertainment "Music hath charms to soothe a naked breast"—no, a naked savage,—oh, dear NO, I mean a savage breast. But, *why* is music? Why should lonely monks and bishops on the old continent have shut themselves up within dank dungeons for the sole and express purpose of doing research upon music? Whatever answers there be, must needs comport with that fundamental doctrine: MUSIC ATTRACTS PEOPLE.

There's a fortune in gold in good music—for the good composer. A composer will rush around fiercely seeking inspiration—beat his brains, and drink black coffee—but a composer, y'unnerstan', he dunno *why* is music. How can a composer get mood into music—his music being but a super-complificated matrix of vibrations within vibrations? But you just play a phonograph backwards, and you'll get the integrated ballistics of inverted syncopation—funny thing, but some of these modern English "songs" (really, they're most silly doggerel rhymes) when spoken "backwards" sound like Greek, Hebrew or Polak. Listen to this one:

"Hooey vin vawr lamia"

—isn't that just swell Greek? It means, "I'm in love with you," from that Freedman-Whitson dance hall classic, "Let Me Call You . . ." Oh, heck, how does a phonograph turn backwards, ordinarily—it don't? When the spring of the machine is RUN DOWN, spin the record backwards with the forefinger (See Fig. 1).

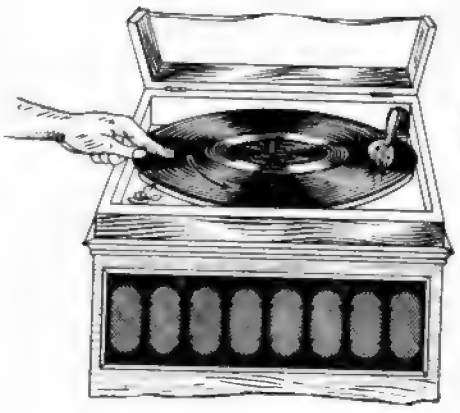


Fig. 1—The above drawing shows how a record is turned backwards.

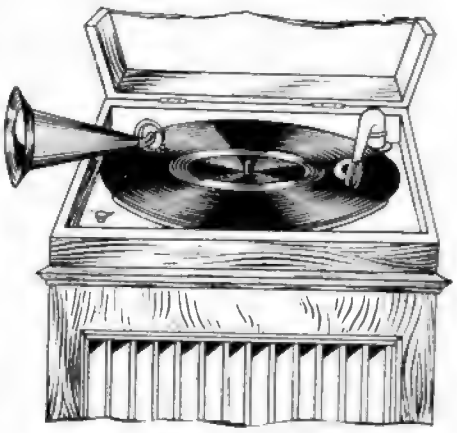


Fig. 2—The system of double reproduction is illustrated above.

I've got an old-time phonograph—one of those horn affairs. One day I held the horn on a record being played on another machine, so two horns were reproducing *a instanto*—and what an interference—WOW! A colored gentleman was singing "All In Down and Out" (it was Bert Williams) from one horn, and the other horn caught him repeating the whole thing one step behind—somehow, the suggestion was conveyed that here was indeed a TIME MACHINE, even more so than a clock. I suppose old man Einstein could imagine funnier things belonging to the time dimension. . . .

A portable phonograph with a busted spring is temporarily dead—but it can be spun around with the forefinger to continue its former capacity as an entertainer. The chap illustrated in Fig. 3 is doing just that—but he is furthermore investigating into a peculiar "nerve reflex" in his body. With one hand he turns the record—*a correcto*—and he is turning his right foot (shoe) in the same direction of rotation. That is comparatively an easy task—but, if he wills to

(*Continued on page* 856)

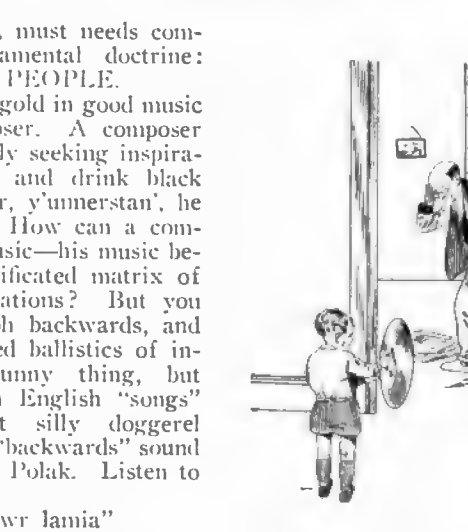


Fig. 4—Above we see how the "diabolic sound ray" is produced by using a reflector for directing the waves.

Fig. 3—A nerve reflex can be demonstrated with the right hand and foot as shown above.

Fun With Music

ANYONE possessing a phonograph has the raw material for executing a number of risible stunts. Even a broken machine can be employed in performing some of the tricks described. Little additional apparatus is necessary.

Fig. 5—Sound waves pass through the body of the man standing in front of the phonograph. They strike the smoke ring and turn it around 90 degrees.

How to Prepare Dyes and Pigments

Chemical and electrical means of making dyes, which the student chemist will find useful and instructive.

By Eugene W. Blank

Mix phthalic anhydride and resorcinol intimately in a mortar, place in a deep crucible and heat on a sand bath, the bulb of a thermometer being embedded in the sand, and add zinc chloride.

Place the above product, powdered, in a beaker with 250 cc. of water and 10 cc. of hydrochloric acid and stir.

THE art of dyeing is one of the most ancient of subjects. Since the very earliest of times man has known how to color and adorn his personal belongings. Old works of art are noted for their resistance to the ravage of air and light. The earliest dyes were those extracted from the roots and berries of various plants such as indigo and alizarin. But since the latter part of the eighteenth century, when aniline dyes were first discovered, there has been a tremendous increase in the number of dyes being produced. Whereas the early dyes were all obtained from natural sources, many thousands are now prepared artificially from coal tar and its derivatives. A few natural dyes are used at present, but the greater number used are manufactured from coal tar and in many cases severe competition has arisen between the two classes of compounds.

Dyes

FLUORESCEIN is one of the most important of artificial dyes, and it is technically prepared by the reaction between phthalic anhydride and resorcinol. It forms a dark red crystalline powder and when dissolved in alkalies it has a red color and a magnificent green fluorescence.

To prepare it mix intimately in a mortar 15 grams of phthalic anhydride and 22 grams of resorcinol and put the mixture into a deep crucible. Place the crucible in a sand bath and have the sand well packed around it. Heat to 180° C. (356° F.) (the temperature can be ascertained by placing a thermometer in the sand). To the fused mass add 8 grams of zinc chloride, then increase the temperature to 210° C. (410° F.) and keep heating the mass until it is quite dry. Before adding the zinc chloride, it should be well dried by placing in a small dish and heating.

Remove the melt from the crucible with a small knife and finely powder it with mortar and pestle. Place the powder in a beaker with 250 cc. water and 10 cc. concentrated hydrochloric acid. This dissolves all the substances except fluorescein. The fluorescein is filtered from the solution and washed with water. It is then transferred to a watch crystal and dried on the water bath. By closely following directions a large quantity will have been secured.

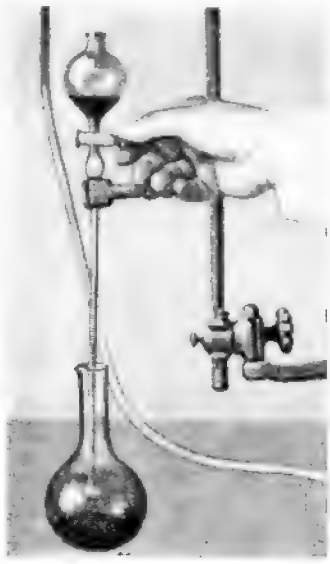
Fluorescein dyes silk and wool yellow, but it is not much used as a dye. Its halogen compound is the magnificent dye eosin.

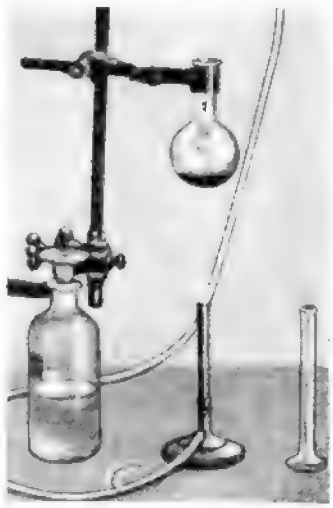
To prepare eosin, place about 10 grams of the fluorescein in a flask and add 65 cc. of alcohol. Place 10 cc. of bromine in a small separatory funnel or burette and allow it to slowly drop upon the fluorescein. As the bromine is added, the fluorescein starts to dissolve and finally a clear, reddish brown solution is obtained. As more of the bromine is added, the tetra-bromide forms and separates out in the form of dark leaflets.

When all the bromine has been added, the reaction mixture is allowed to stand for two hours, and then the precipitate is filtered. Wash several times with alcohol and finally dry on the water bath. During the heating the color of the dye becomes brighter. As eosin is insoluble in water, the sodium salt or ammonium salt is largely used for dyeing.

To prepare sodium eosin, mix six grams of eosin with one gram of dry sodium carbonate. Place the mixture in a small flask and moisten with water and then add six cubic centimeters of alcohol. Heat until no more carbon dioxide is given off. Add thirty cubic centimeters of alcohol to the mixture and heat. Filter the solution while hot and on

(*Continued on page 856*)



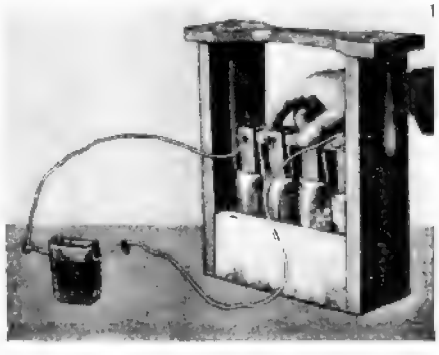


Kanaria, a yellow dye, is prepared by decomposing a solution of potassium sulphocyanide in water by electrolysis.

Natural Organic Coloring Matter, by Perkin and Everest.
Synthetic Coloring Matters, by Hewitt.
Synthetic Coloring Matters, by Thorpe and Ingold.
Dyes Classified by Intermediates, by Shreve.
The Factory Practice in Manufacture of Azo Dyes, by O'Brien.
Coal Tar Dyes, by Fay.
Names of publishers gladly furnished on request.

To prepare eosin, place 10 grams of fluorescein in a flask and add 65 cc. of alcohol. Place 10 cc. bromine in a dropping funnel and allow it to drop into the flask.

To prepare sodium eosin, mix 6 grams of eosin and 1 gram of sodium carbonate, add 6 cc. of alcohol and heat slowly.



First of New Series of Brain Teasers

By Sam Loyd

Twenty-five Dollars in Prizes

WE have in this issue the first two specimens of a series of the puzzle man's best brain-teasers; one being of the popular word-puzzle variety and the other with a mathematical flavor.

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the two puzzles *accompanied by the best expressed analysis of the "1930" puzzle.* While this problem may yield to experimental methods, actually its solution involves a principle in fundamental mathematics well worth learning.

A SECOND PRIZE of $5 will be awarded for the next best analysis and correct answers to the two puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analyses of the "1930" puzzle, together with correct answers to the two puzzles.

Answers must be received not later than noon January 15th, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

Answers and prize awards will appear in the April issue of SCIENCE AND INVENTION.

The Canny Scot and the 1930 Puzzle

HOOT mon," I shouted to Sandy MacNab as we passed on the street, and my greeting brought forth a reply from the canny Scot that was both witty and puzzling.

The skeleton of Sandy's retort is set forth in the strip of type in his right hand. Just sprinkle one certain letter among those O's and H's to make Sandy's remark complete. It will be in the form of a palindrome, that is, it will read the same from top to bottom as from bottom to top.

The palindrome is probably the earliest form of word-puzzle, especially if it is true that Adam introduced himself to Eve in the words: "Madam, I'm Adam." The most famous of palindromes is that which might have been appropriately uttered by Napoleon: "Able was I ere I saw Elba." You see, it reads backward as well as forward.

The 1930 Puzzle

In Sandy's left hand are displayed the ten digits with which we perform all arithmetical calculations. They are called digits because man first learned to count upon his ten fingers or digits.

Let us see who can arrange the ten figures in a sum which will add up 1930. All ten figures must be used and none more than once. It is permissible to employ proper fractions, but the top-heavy sort is barred.

Sam Loyd the Puzzle King

ALTHOUGH "a prophet is without honor in his own land," surely a king needs no introduction to his ardent disciples. A conservative, statistical friend of Sam Loyd came to the conclusion a number of years ago that the puzzles invented at that time by Mr. Loyd had reached at least 300,000,000 people. These figures, says Sam Loyd, cannot look him in the eye. However, the fact remains that he is the worshipped idol of all puzzle fans—and where is the person who can resist the urge to get on the mat for a tussle with a puzzle that impishly challenges—"Let's see you guess me."

The editors must therefore be forgiven for their justifiable pride to be able to offer their readers the latest of the Puzzle King's interesting and baffling—we hope—efforts. It is, however, with some trepidation also that we send into the world these brain-children of Sam Loyd's. Right here and now we disclaim any responsibility to any reader willing to risk insanity or worse. There is no telling but that Mr. Loyd may create another furore, with even more disastrous results than his famous 14-15 puzzle 'way back in the '80's. This puzzle, we are informed from an authoritative source—Mr. Sam Loyd, himself, to be precise—"burst upon our unsuspecting planet like a meteor out of the sky. The shattering reverberations of its arrival spread with almost the speed of light to the furthermost corners of the globe. It leveled caste and melted hard human hearts. Like a medieval plague, it played no favorites among its victims, and old and young, rich and poor, wise and otherwise succumbed to its irresistible onslaught." Although the editors of SCIENCE AND INVENTION are generally meek and genial souls, they are looking forward with keen anticipation to the results of this newest puzzle creation of Mr. Loyd's.

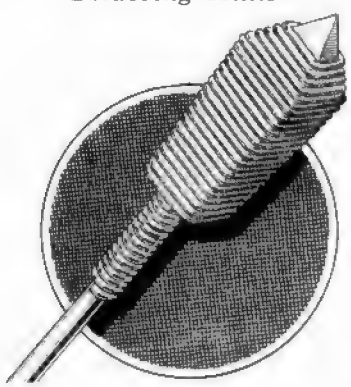
HINTS *for the* HOME WORKSHOP

First Prize $10.00

Temporary Mitre Box

TO overcome the handicap of a broken mitre box, the following procedure was employed. Two strips were nailed lightly with brads on either side of the line on which I was to saw and on both sides of the chord. A square was used to place the strips on the wood.—*Vernon V. Johnson.*

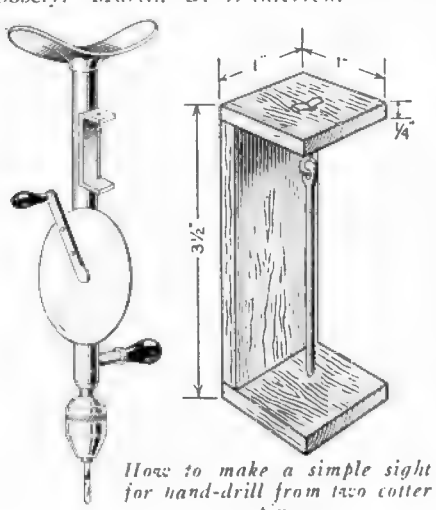
Soldering Hints



SMALL soldering irons will retain heat if plenty of copper wire is wrapped around them, leaving only the tip free."—*Dr. Ernest Bade.*

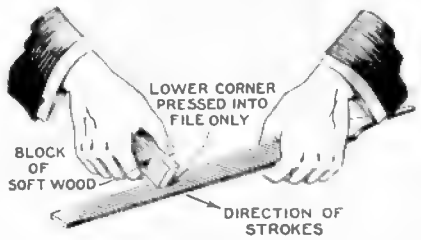
Handy Drill Sight

TWO cotter pins, one 1 inch long and another 3 inches are linked together in the end where they open. The smaller one is fastened to the upper block in a hole drilled in the center of the block; the other cotter hangs loosely.—*Martin G. Winterton.*



How to make a simple sight for hand-drill from two cotter pins.

Cleaning a Flat File

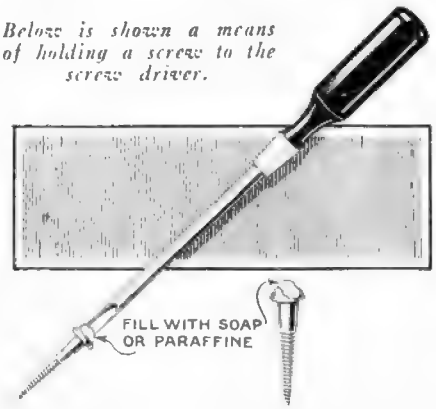


TAKE a small block of soft wood. Hold file firmly on flat surface with the hand. Using the front bottom edge or the corner of the block of wood, which will take the form of the teeth and grooves, slide the block along the grooves or directly across the file.—*Frank Placerian.*

Holding Screws in Line

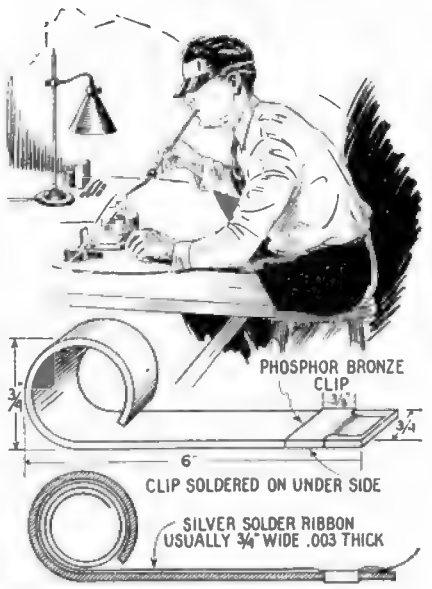
WHEN it is necessary to put a screw in a close place, a screw-holding device is not always at hand. If the slot in the screw head is rubbed over a piece of beeswax, soap or paraffin, so as to fill the slot, the screw will stick firmly to the screw driver.—*David Jenkins.*

Below is shown a means of holding a screw to the screw driver.



$10.00 MONTHLY FOR BEST HINT

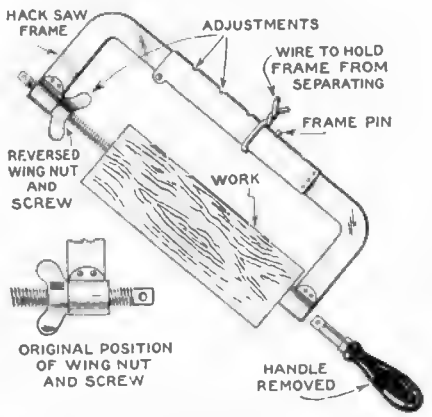
SEND us a photograph or sketch of your own hint for the home workshop. $10.00 is paid monthly for the best hint accepted and published. Others that we publish are paid for at regular rates. Here is a chance for you to win a prize for a useful workshop hint.



Solder Dispenser

TAKE a strip of brass or other suitable material, 8" long, ¾" wide and 1/16" thick. Curl one end into a ¾" loop, leaving an opening as shown in sketch. Fasten clip to underside of holder, then slip solder into curl of holder.—*B. K.*

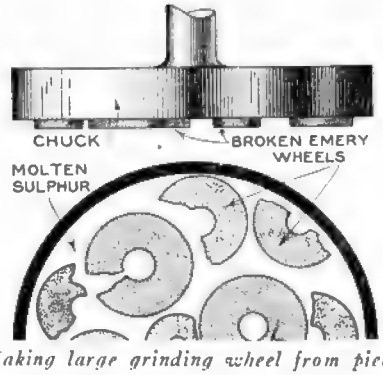
A Hack-Saw Vise



REMOVE the handle, wing nut, and screw that tighten the blade, and insert them in the frame again so that they are reversed. A piece of wire is wound around the center to keep the frame from springing apart.—*Frank Placerian.*

Novel Polishing Wheel

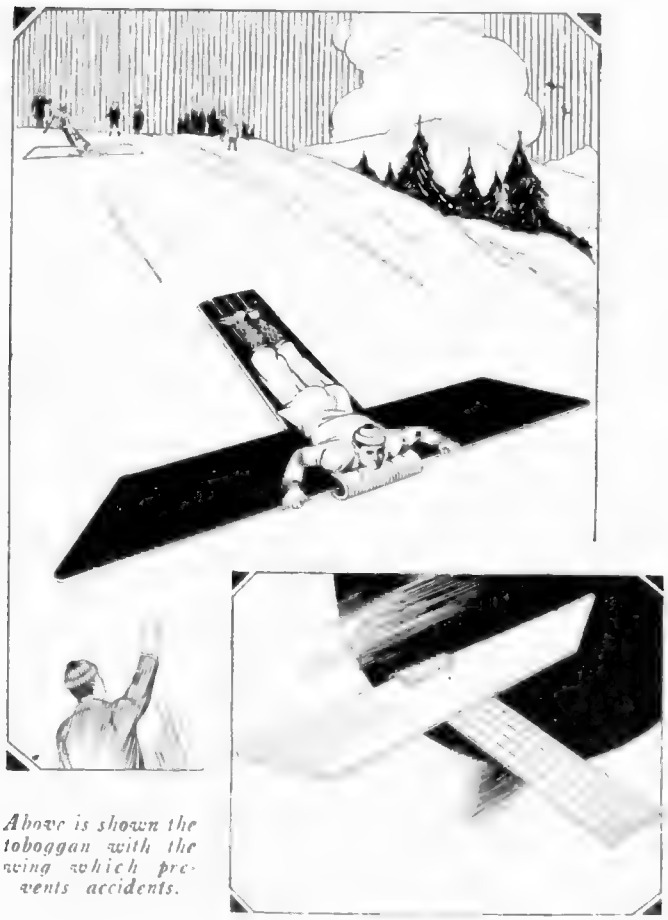
TAKE a head or chuck about ¼" to ½" deep and lay in broken carborandum or small broken emery wheels. Melt sulphur and pour in around pieces while hot.—*H. Pfeffer.*



Making large grinding wheel from pieces.

How to Make It

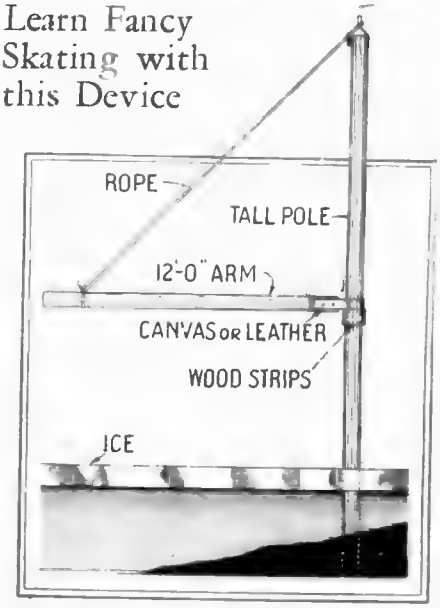
Winter Fun on a Toboggan-Ski



Above is shown the toboggan with the wing which prevents accidents.

WINTER has come and the snow covered hills beckon with the white hand Jack Frost. But many are the attendant dangers of winter sports, skiis that trip their ungraceful owner, sleds that refuse to stop and toboggans that like to leave the slides. Pictured here is a device which combines the speed of the skiis and toboggans with the safety of a good old bob-sled. A wing-like projection is attached to the prow of the toboggan, as shown in the illustration, and projects about three feet on each side. No longer need the winter sportsman fear for the sharp curve or the depression at the foot of the hill. *P. V. Van Pettingen.*

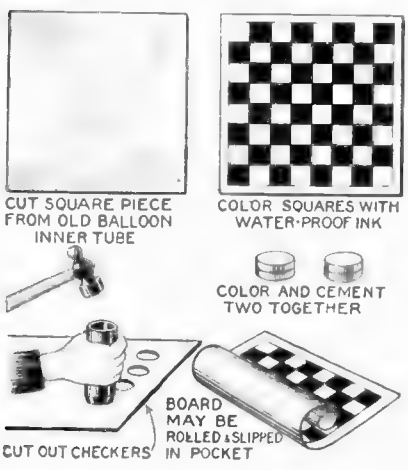
Learn Fancy Skating with this Device



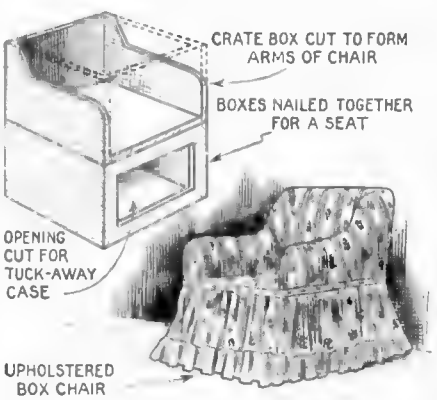
YOU can construct, very easily, this device for learning fancy skating with a long pole, a cross-arm of 10 or 12 feet long, a rope, several pieces of wood 1 inch thick and a strip of leather or canvas. Whittle down the top of the pole until it is pointed, then bore a ½-inch hole in the top 6 inches deep. Drive a ¼-inch rod 12 inches long into this and fasten one end of a rope around it with a non-slipping knot so it won't tighten. Set the pole through the ice to freeze. Nail the wooden blocks on the pole five feet above the ground and tie the cross-arm to the pole with the leather strip.—*Dale Van Horn.*

Rubber Checker Board

A NOVEL checker board can easily be made from a discarded rubber inner tube. First clean with a steel brush, mark into squares (64) and color them with India ink. Paint with elastic varnish to make board smooth. Cut checkers to size from tube and coat with elastic varnish.—*Edward A. Kallal.*


CUT SQUARE PIECE FROM OLD BALLOON INNER TUBE
COLOR SQUARES WITH WATER-PROOF INK
COLOR AND CEMENT TWO TOGETHER
BOARD MAY BE ROLLED & SLIPPED IN POCKET
CUT OUT CHECKERS

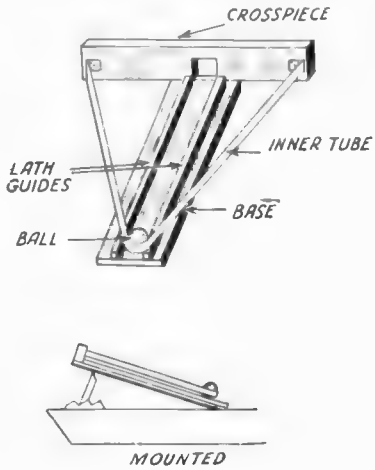
Crate-Box Armchair



A VERY useful and easily constructed armchair may be made from two grocery boxes. Remove the cover and one side of a box. Cut each end down to a height of 5½ or 6 inches from the top. This will form the body of the chair, comprising the seat, back, and arms. For upholstering use an old blanket or quilt for the inside padding. —*Manki Field.*

A Snowball Catapult

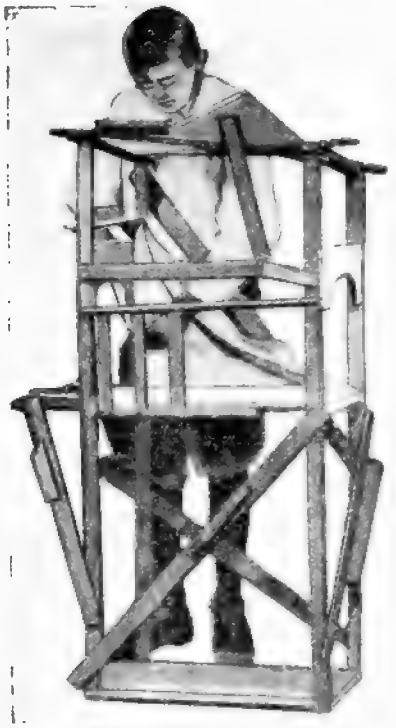
THE baseboard is 48 inches long and 6 inches wide. Two laths are used to guide the snowball. The cross-piece is 18 inches wide, 2 inches in thickness and 4 inches in height. A hole is cut in the cross-piece to allow the ball to go out. The inner tube is 3 inches wide and about 50 inches long.—*E. Ozag.*



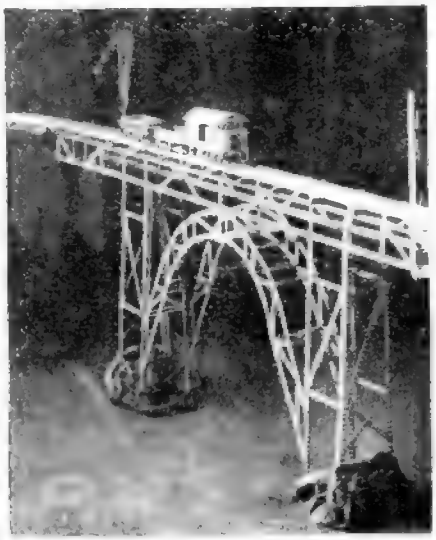
TOY TUNNELS

Easily Made

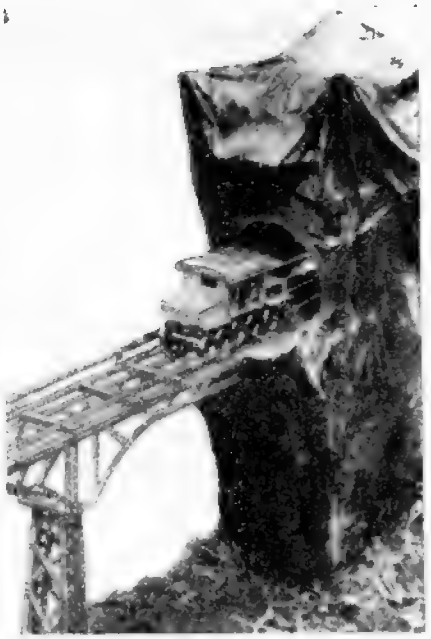
By Dr. E. Bade



The first step in the construction of toy tunnels is the skeleton framework. As may be seen, this easily built framework is for an elevated tunnel.



This arched bridge, which can be used in conjunction with an elevated tunnel, is very readily constructed with the aid of one of the well-known toy construction sets.



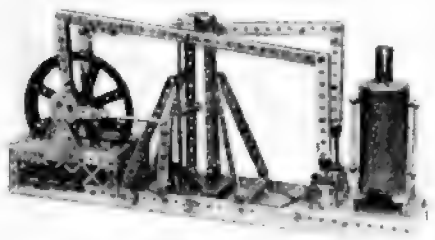
The finished tunnel will look like the above. This particular type of tunnel, interconnected with a toy construction set railway, simulates a bore through a mountainside.

CHILDREN always like to have a tunnel for their train, but the larger ones are quite expensive. Strong, substantial tunnels are not at all difficult to make and require very little material. First, any kind of a board is taken which must be almost twice the width of the train to go through the tunnel. The length of the tunnel is immaterial and depends upon the length of this board. A rough skeleton of thin strips of wood is nailed to the sides of this board and these give the outline of the finished tunnel. After nailing these strips together, take some old bags or, better yet, some old potato sacks and nail these to the skeleton frame. While doing this provide as many folds in the covering as possible. This will heighten the final effect.

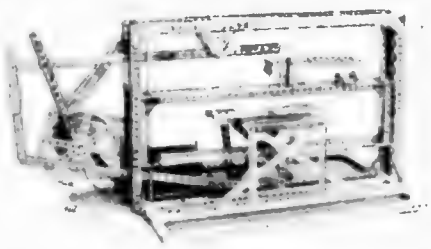
The tunnel is now almost finished except for stiffening and color. Stiffness is provided by painting the entire cloth frame with free running carpenter's glue. When dry, the process is repeated. After the third coat has been applied and has dried, the old bags will be quite stiff. There are two or three ways in which the tunnel may be colored. The simplest is to brush on another coat of glue and, before the glue dries, ground earth colors of various shades of brown are sprinkled over the frame. In among these brown shades a few grains of brighter colors are sprinkled, such as blue, red, yellow and green. To increase the effect and to make the tunnel seem as if cut from rocks, sand is sprinkled on at the same time that the colors are added. The tunnel may also be colored by adding small portions of glue to the ground earth colors and painting these on "any-which-way." These earth colors mixed with glue dry rapidly and are just as effective as if oil paints were used.

When making an elevated railroad, the tunnel must naturally be placed on some support. Under these conditions the tunnel, while still in its skeleton stage, is provided with four legs which are braced internally and the bags are made to cover the lower part as well as the upper part of the tunnel.

NEW TOYS *from* CONSTRUCTION SETS



Walking beam engine that works.



Working model of a motor-driven fret saw.

TOYS, from which any number of models may be made, have a fascination of their own. The walking beam engine, illustrated, operates by means of two solenoids alternately energized. One coil being energized, pulls down the "piston" connected to a crank on the fly-wheel. The piston reaching its lowest point just after dead center on the crank has been reached, the second solenoid is energized and the operation repeated with the second piston. The current, which may be from any source of electric energy, is distributed from two binding posts to two spring sliding contacts to prevent oxidizing tendency of sparks. This contact is adjusted by means of an eccentric on the fly-wheel shaft.

A useful fret saw can also be readily built. A vertical frame lies in the center of a horizontal one the same size. A table to support the work is fastened in the center of the vertical rectangle. The saw frame slides within the vertical frame on two rods and operates by two long levers connected by vertical strips. The fulcrum is one-quarter the distance from one end of the main vertical frame. A short strip connects the long lever with a fly-wheel, operated by a small electric motor with reducing gears. The saw, which can be obtained in any hardware store, is fastened to the center of the small movable frame, the lower end being inserted into a slotted coupler fastened to this frame. The upper end contains a coupler that can be raised or lowered. The proper tension is obtained by a lever, eccentric arm and ratchet. A guard to protect fingers may be attached.

Writing *and* Stationery Cabinet

By J. E. Lovett

THE fitted interior of this writing and stationery cabinet provides ample accommodation for writing material and a few books of reference, while the flap when opened forms a convenient writing slope. The cabinet, which measures 18 inches by 18 inches by 10 inches deep, should be made in oak..

The principal parts are cut from ½-in. timber.

The ends or sides are shaped as shown at Fig. 4, the top is 17½ inches long by 7¼ inches wide. Rebates are cut at the back edges of the sides for the reception of the back, and dovetail grooves are cut to receive the top and bottom, as shown at Fig. 4.

The back is 17½ in. long by 16 in. wide by ¼-in. thick (oak plywood will answer, if the solid oak is not available), with its top edge shaped as shown, being pinned to the sides, top and bottom.

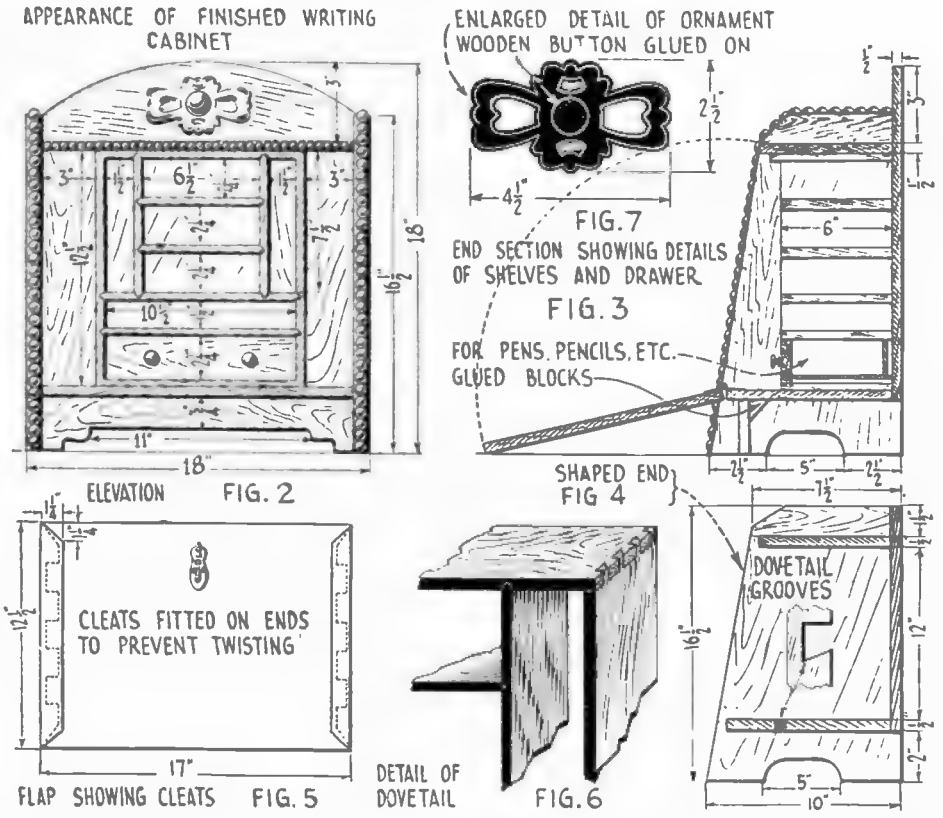
The small shaped rail which is fitted under the bottom is shown at Fig. 2. It is grooved into the sides, and is fixed under the bottom with glued blocks as at Fig. 3.

The flap is of ½-in. timber, framed at the ends 1¼ inches wide, as shown at Fig. 5. It is hinged to the bottom, and should be fitted with a lock and key or ball catch.

The interior fittings should be of ¼-inch material.

The sides, top and bottom are dovetailed; this

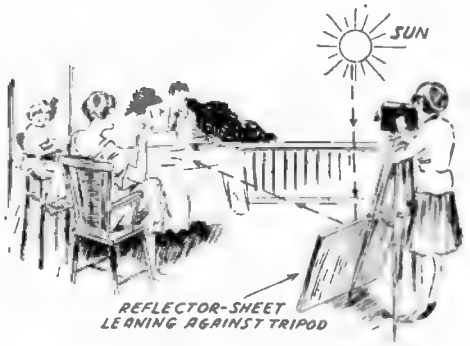
(*Cont. on page* 855)


APPEARANCE OF FINISHED WRITING CABINET
ELEVATION FIG. 2
ENLARGED DETAIL OF ORNAMENT WOODEN BUTTON GLUED ON
FIG. 7
END SECTION SHOWING DETAILS OF SHELVES AND DRAWER
FIG. 3
FOR PENS, PENCILS, ETC.
GLUED BLOCKS
SHAPED END FIG 4
CLEATS FITTED ON ENDS TO PREVENT TWISTING
FLAP SHOWING CLEATS FIG. 5
DETAIL OF DOVETAIL
FIG. 6
DOVETAIL GROOVES

The appearance of the finished writing cabinet and details for its construction are shown above. Ample accommodations for writing material and several books are provided as well as a flap which forms a support when writing.

Reflectors *for* Amateur Movie Makers

By Raymond B. Wailes



The reflector sheet can be supported by the tripod as illustrated above.

THE cause for poor results with the use of home movie and still, or ordinary cameras, is the lack of light upon the subject. In using amateur movie cameras, it is necessary to have sufficient, but not an excess of light, on the subject being photographed. Over exposure is as bad as under exposure. Give the subject plenty of light, but control the light by the use of a reflector.

Home-movie cameramen will find the use of a large sheet of wall-board as a mirror a decided asset to their equipment. As the sketches show, the use of it "on location" seems rather primitive; but nevertheless it produces the results—that of lighting up the shadows in the picture, for instance—reflecting the light up and under the chin of the subject, and under the hat visors, etc.

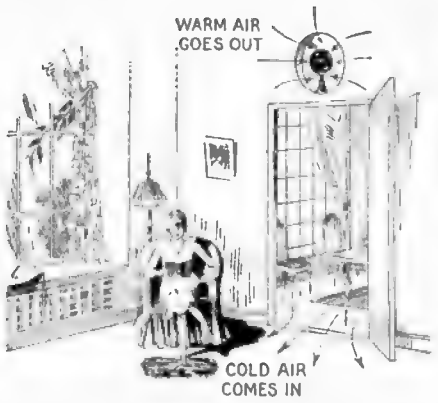
A sheet of wall-board as large as can be conveniently painted with aluminum paint and fitted with screen door handles is easy to handle. A small stick set up in back of a sheet will act as a prop to reflect the skylight upon the subject. One means of supporting the sheet is simply leaning it against the legs of the tripod, if one is used.

A hand spot or flood lamp can be made easily with a lamp shade and a 200 to 250 watt lamp.

Enameled kitchen table tops or composition board make excellent reflectors.

By reference to one of the sketches it can be seen that the sheet of board should be placed so that the angle A is equal to the angle B. The full sunlight is reflected upon the subject only when this is so. Even with no sun in the sky, the reflecting board will cast light upon the subject from the sky, brightening up the shadows.

(*Continued on page* 856)



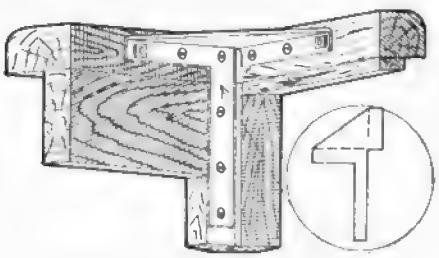
Wrinkles

Winter Use for Electric Fan

$5.00 FIRST PRIZE

YOUR electric fan may be made to earn its keep in the winter as well as during the summer months. Many times it is found that in the workshop as well as in some homes the room containing a heater or register will be quite warm and the adjoining rooms cold. All that is necessary is to install the electric fan in a hole cut above the door between the two rooms and to leave the door open. This gives a constant circulation of air that keeps both rooms at the same temperature.—*Kenneth B. Murray.*

Removing Car Body Squeaks



THE practical way to eliminate squeaks in an auto body, due to the springing of joints in the wooden frame, is to reinforce it with a metal bracket, which may be attached with wood screws and bolts. The flanged triangular section of the bracket forms a rigid brace for the top joint and the leg serves to support this from the pillar.—*C. T. Schaefer.*

Sack-Pouring Device

THE process of pouring sugar or other material from a paper sack is a tedious one. Try this: Cut off the bottom and top of a tobacco can,

insert it into the mouth of the bag and then put a rubber band around it as shown in illustration.—*Frank W. Bentley.*

Making Balsa Spars for Model Boats and Airplanes

IN forming round spars from balsa and other light woods for model airplanes and boats, a simple method is to select a nut with a hole slightly smaller in diameter than the desired size and to drive or draw the strips through it.

The reason for using a nut of smaller diameter than the finished spar is that the spar will expand slightly after being drawn through. Pass the strip through the nut several times to insure uniformity.—*Simon Cherry.*

A Simple Rubber Stamp Rack

OFFICE workers who must use several rubber stamps in their duties and who are forever getting their fingers stained with stamp-pad ink in picking out the correct rubber stamps will find a great time saver and temper saver by investing in a few metal screw eyes. By hammering some small nails on the inside of the desk drawer and screwing the screw eyes in the ends of the stamps there will result an efficient "stamp rack." Hang the stamps on the nails.—*E. L. Dunbar.*

How to Render Paper Fireproof

WHETHER the paper be plain, written, printed, or even marbled, stained or painted for paper hangings, dip it in a strong solution of alum water and thoroughly dry it. In this state it will be fireproof. It will carbonize in a fire but will not blaze to any extent.—*Eugene D. Yates.*

Animated Toys

FOR purposes of display or nursery amusement, small floating objects, such as boats, etc., if put in a round bowl, will be kept moving in a circle if a piece of gum camphor is dropped into the water. This keeps pushing the water from it and the objects keep going in a circular motion without other assistant.—*E. L. Dunbar.*

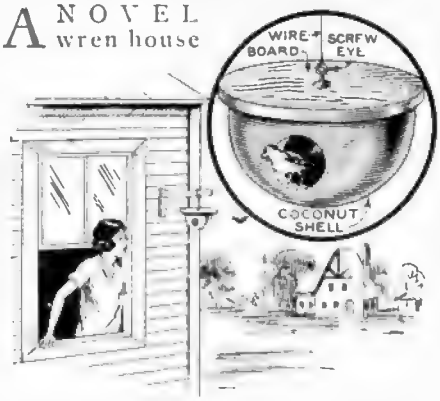
(NOTE: *Small pieces of camphor about the size of peas can be tied together, preferably by passing the thread through the center of each piece. When this chain in dropped into the water it will move like some strange water animal. The slightest bit of grease on the surface of the water will stop all movement.*—*Editor.*)

Patching Sacks

OLD sacks may be patched by pasting a patch of the same material over the holes and ironing. The heat of the iron hardens the paste and the patch will outwear the rest of the sack. Common flour paste is used.—*Vernon V. Johnson.*

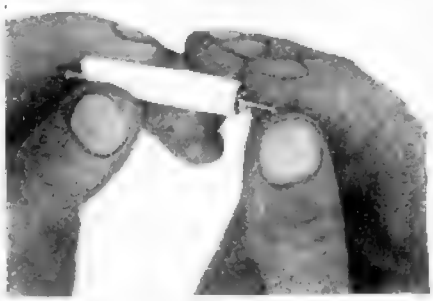
Cocoanut Shell Bird House

A NOVEL wren house



may be made from a cocoanut shell. A 7/8-inch hole is drilled in the shell for a doorway and the milk is drained off. The top of the shell is next cut off with a hacksaw and the meat is scraped out. The shell is glued to a board about 7 inches square, which may be painted any desired color. Then a screw-eye is put in the center of the board for a wire hanger.—*Vernon V. Johnson.*

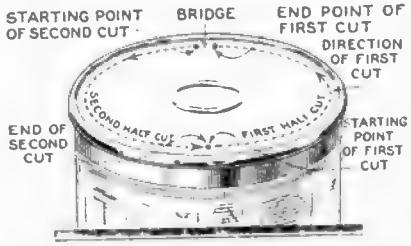
Cigarette Pin Cushion



A HALF of a cigarette, any brand, will make an excellent pin cushion. The tobacco and paper will hold a great many pins securely and safely even after some of them have been removed.—*Frank W. Bentley.*

Improved Can Opening

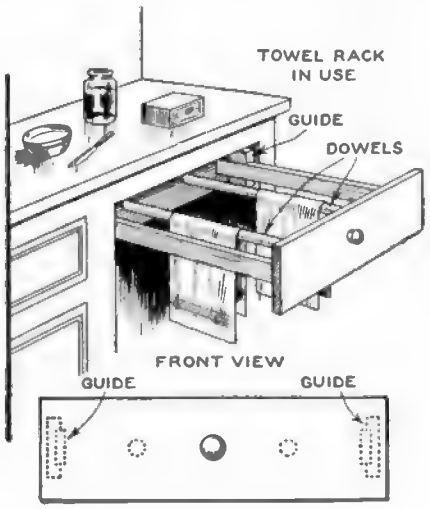
FOR easy and clean opening of a tin can, cut the top about half way. Leave a bridge of 1/8 inch and then make another cut to the original starting point.—*Rudi W. Mandl.*



and Recipes..

Handy Kitchen Towel Rack

THIS consists of 2 pieces of ¾-inch wood, two lengths of dowel stock to slip into holes drilled in the end pieces,



and 2 strips of ⅜-inch wood, forming slides which are fastened with screws. A knob in front serves for pulling rack out.—*Vernon V. Johnson.*

Sharpen Razor on Paper

ON a motor tour I forgot my razor strop. I got a newspaper, folded it and tied both ends. The paper fold was of six thicknesses, the length that

of an ordinary razor strop. I stropped my razor in the usual manner and found this novel strop to be very efficient.—*August Jeffers.*

Decorating Polished Tools

COMMERCIAL-LOOKING whirled decorations on tack hammers, hunting knives, flat metal parts of guns, paper-weights, or anything of steel can be made by a drill press, a piece of cork and some fine valve-grinding compound.

The compound with a little oil is spread over the metal object while a round piece of cork (wood will do, but is not as good) is placed in the drill press instead of a drill. Rotating the cork over different parts of the object will result in overlapping whirls, making the article look much better.

A hand drill can be used if a second person holds the cork in one spot. For this purpose use a board that has a hole in it the size of the cork.—*A. O. Flinner.*

$5.00

will be paid each month for the best wrinkle or recipe submitted to the editors and which they accept and publish in these columns. All other ideas accepted and published in this department will be paid for at regular rates. Address your ideas to—*Editor Wrinkles and Recipes.*

How to Make a Reducing Glass

TAKE an ordinary wafer razor blade and fill one of the holes with water. The drop will remain suspended. Any picture can be viewed through it, greatly reduced in size. Hold the blade about one inch above the picture. The picture should be upside down, since the image is inverted. It is often desirable to know how a drawing will look when reduced for printing. This method is especially suited for viewing illustrations which are to be greatly reduced in size.—*Frank Schmulowitz.*

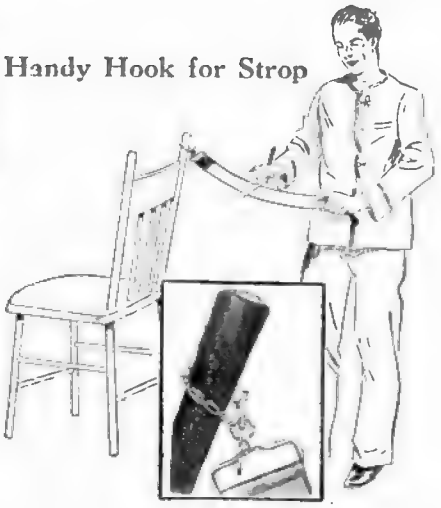
(It would always be a good plan to cover the illustration with a piece of glass, to prevent the water from accidentally dropping on a pen-and-ink drawing.—Editor.)

Brown Stain for Wood

AN excellent yet simple brown stain for wood consists of a saturated solution of potassium bichromate in water. It needs no rubbing and leaves a brown satin-like finish, which cannot be produced by pigments. An excellent surface for applying a finish is left.—*Elbra Welsch.*

(Potassium permanganate, used the same way, is also excellent.—Editor.)

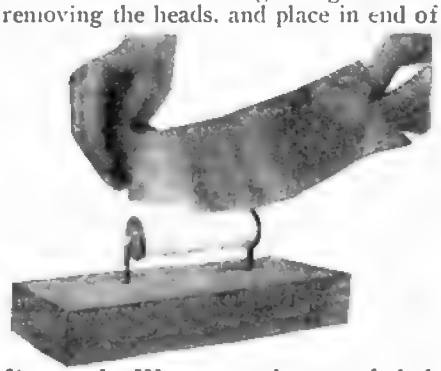
Handy Hook for Strop



THE tourist frequently finds it difficult to locate a convenient hook for his razor strop. Here's a novel one. Take a small brass safety chain. Put the first link on the eye of the strop, as shown. Insert a match, nail or other bar-like object between the two. This will hold the strop very well.—*Frank W. Bentley.*

Adhesive Paper Moistener

AN old film spool can be used very handily for this purpose. Bend the ends of two nails at right angles, after removing the heads, and place in end of



film spool. Wrap several turns of cloth about spool and then submerge it in water until thoroughly saturated.—*—Frank W. Bentley.*

A Trick Cigarette

THIS simple trick consists of inserting a toothpick into an ordinary cigarette. When it is smoked in a holder the ashes will have a tendency to adhere an unusually long time, occasionally until the cigarette has been smoked way down to the holder.—*Leslie F. Carpenter.*

Readers' Opinions and Comments Will Be Welcomed by the Editors

What Our

Jupiter's Light

Editor, SCIENCE AND INVENTION:

While reading some of the articles in your magazine, a confusing problem arose, which has caused considerable dispute. This we are submitting to you for final determination.

Is the light that is emitted by the planet Jupiter, its own light, or is it merely the reflection of sunlight?

Does Jupiter emit its own light, thereby making it visible to the other heavenly bodies, without the assistance of the sun's rays?

MARTIN HERSH,
Hopewell Junction, N. Y.

(Until recently it was supposed that the rapid changes of the surface markings of Jupiter were due to cloud formations and that the planet had to be almost red hot to cause such a rapid change.

In 1914 and 1922 Dr. Coblentz showed that the radiation which comes to us from

the planet is almost entirely reflected solar radiation, and he proved that the temperature of the surface of the planet Jupiter was near —140° C. This is just about what might be expected if but little heat comes up from the interior of the planet. The assumption then is that the atmosphere about Jupiter consists of permanent gases and the clouds might be condensed particles of carbon-dioxide or other substances which are familiar to us as gases, but which boil vigorously at temperatures even far below zero. While Jupiter may be hot inside it is not self-luminous.—EDITOR.)

The Ouija Board

Editor, SCIENCE AND INVENTION:

I would greatly appreciate your information about the Ouija Board. Does it really reveal secrets, hidden events, or is it a humbug?

You deny supernatural power (spiritualism) in its operation; so do I. But on the other hand many honest persons affirm that the Ouija Board's foretellings proved to be facts.

In the November issue of your splendid magazine you acknowledged your belief that our subconscious mind is the causative

factor in the operation of the Ouija Board. What does that mean? Would like to know a little more about this mystery.

REV. LOUIS UNGER,
Hamtramack, Mich.

(There is no doubt but that in many instances messages, supposedly delivered by a Ouija Board operator, foretold what subsequently came true. These cases are pure coincidences. In many others the Ouija Board message was so perverted as to make it fit the circumstances. SCIENCE AND INVENTION magazine, as you undoubtedly know, has a standing offer of $1,000.00 which it will pay to anyone who will produce any readable message on an Ouija Board, the letters of which have been transposed by us and the operator, securely blindfolded. Up to the present time no one has been able to produce even one readable message.

Most of the individuals who operate Ouija Boards do not know that they themselves are controlling the movements of the indicating device. Nevertheless, subconsciously they are doing so. It is this same mind, so to speak, that acts when we are dreaming. We are not consciously aware of the experiences through which we pass when dreaming. The same is true of a bonafide Ouija Board operator. He does not know that it is his own mind that is causing the movement of the indicating dial, planchette or other signaling means. —EDITOR.)

More Pages

Editor, SCIENCE AND INVENTION:

Every succeeding number of your monthly leaves me with a growing sense of irritation against a feature that is more obvious the more interesting your journal becomes. I refer to the short distance between its outer covers and I would be glad as no doubt would many other readers, if this one fault in an otherwise faultless publication could be remedied. You will better understand just how highly your magazine is appreciated here when I remind you that Clydebank is in Scotland, and that I fully realize that a larger monthly might well result in its increased cost.

With every best wish for your continued success,

JAMES A. HANNAH,
Clydebank, Scotland.

(The number of pages in SCIENCE AND INVENTION magazine is substantially the same as it has been for several years. There has been no decrease in the amount of text space. Now, however a greater number of articles are found within the cover pages. You may rest assured that should there be a change in the text matter in this publication it will be in the nature of an increase rather than a decrease in the number of pages.

We thank you for your compliments.—EDITOR.)

Headless Insects

Editor, SCIENCE AND INVENTION:

I am a regular reader of your magazine. If I remember rightly you once published an article about some scientists who kept the head of a dog alive for a considerable time after it had been severed from the body.

Quite by accident I snapped the head of a fly from its body with a rubber band. I was surprised to see that the fly's body continued to live for nearly twelve hours and every time it was touched the fly would buzz around. I thought perhaps that you might be interested in this fact.

JAMES SIMMONS,
Fort Dodge, Iowa.

(The further one goes down the evolutionary scale of animals the more easy is it to keep the bodies of animals alive, even though the head has been completely severed from the body.

If one of the arms of a starfish meets with an accident the injured appendage is cast off near its base and after a time a new one grows out. The body of such a starfish can be cut in two and each of the parts can regenerate the other parts that are missing. The same is true of earth worms. If the body of an earth worm should be cut in two, no particular harm results.

Many experiments have been made in grafting the head of one insect to the body of another. These were described in past issues of this publication. However, the experiment with the dog's head is the first one that was ever made with an animal considered to be so highly developed. —EDITOR.)

Readers Think

Questions and Discussions of General Scientific Interest

The Faucet Problem

Editor, SCIENCE AND INVENTION:

This problem was presented to us by a party who could neither prove nor explain the answer to us satisfactorily.

There are four buckets, each holding an equal quantity of water. This quantity is unknown.

Bucket No. 1 is set under a faucet and takes one hour to fill.

Bucket No. 2 is likewise set under a different faucet and takes two hours to fill.

Bucket No. 3 is set under a third faucet and takes three hours to fill.

Now if all of these faucets are turned into the fourth bucket how long will it take to fill this bucket?

This is the way it was explained to us—Bucket No. 1 takes 60 minutes to fill; No. 2—120 minutes; and No. 3—180 minutes or a total of 360 minutes for all. The individual then divided the total by ten.

We are at a loss to see where he got 10, nor can he explain it satisfactorily. He tells us the answer is 36 minutes, when all three faucets are run into one bucket, but we cannot prove that he is correct.

MISS JESSIE L. GREEN,
MISS DOROTHY H. ROESE,
Noroton Heights, Conn.

(The answer as given is incorrect. Here is one of the easiest ways of figuring out this problem. Supposing we take 360 minutes as the lowest common denominator, using the other time intervals of 60, 120 and 180 as the numerators. You will then find that faucet number one will fill six buckets of water in 360 minutes. Faucet No. 2 will fill three buckets of water in the same length of time and faucet No. 3 will fill two buckets of water in the same interval. Therefore, 11 buckets of water will be filled in 360 minutes or one bucket of water will be filled by all three faucets in 32 8/11 minutes or 32 minutes and 43.6 seconds.

Another way of figuring shows that faucet No. 1 fills 1 bucket per hour; faucet No. 2 fills 1/2 bucket per hour and faucet No. 3 fills 1/3 bucket per hour. Adding these together we find we get 11/6 buckets per hour, or 1 bucket in the same interval of time as indicated heretofore.—EDITOR.)

More Dope for Inventors

Editor, SCIENCE AND INVENTION:

As an old reader and booster of your magazine I wish to pass on some advice if you will permit.

Occasionally you publish a page of much needed inventions. I am sure your friends and patrons are interested in inventions and many of them are capable of inventing the things that are now dreams.

If you would continue this sort of a page every month I am sure many readers would appreciate it.

Permit me to say that your publication cannot be beat for inspiration to the ambitious inventor. A Constant Boaster,

L. F. RILING,
Chicago, Ill.

(The Latest Patents department of this publication always shows the ambitious inventor what other inventors are doing along popular lines and this page presents a series of rather good and unusual ideas.

In the Patent Advice department there is frequently a series of questions that are answered in such a way as to help the average inventor. They disclose the reasons for inoperativeness of some of the suggested ideas. It is not always easy for an ambitious inventor to build an apparatus that would completely overcome the difficulties enumerated by the editor of that department. See the answer to the question on railroad crossing gates in this issue.—EDITOR.)

Suggests Other Contests

Editor, SCIENCE AND INVENTION:

I have been a reader of your magazines, SCIENCE AND INVENTION and "Amazing Stories," for the past two years; in fact, ever since "Amazing Stories" appeared on the newsstands. It was through this magazine I was introduced to SCIENCE AND INVENTION. Since that time I have been an ardent newsstand subscriber. I have never missed a single issue.

I can truthfully say that I have gotten more enjoyment from SCIENCE AND INVENTION than from any other magazine; however, there are some things that I consider a loss of time to read, the model department, for example.

The model department is all right in principle, but why must you give a trophy cup as an award? To a man of deeds a cup means nothing, but give him something he can do things with and his joy is unbounded; he is the most grateful of men.

Now, to get to the root of the bush I've been beating around. Why not start a new series of contests to be held, say, twice a year in which all of known sciences are to be represented, in their turn, and to award prizes of worth-while value to agree with the nature of the contest held?

Of course, I'm going to suggest a series of contests. The first concerns that peer of all sciences, one which has done more than anything else in the world to alleviate human suffering, namely, bacteriology.

Suppose a contest is started, say, next September; allow me to suggest a tentative list of conditions. If it were started

in September it would, under these conditions, continue until September of the following year.

For the first condition:

A candidate must submit to a group of eminent doctors and bacteriologists, a series of water-colors in characteristic fields of as many of the known organic parasites and saprophytes as possible.

(2) These shall be painted on a Bristol board of uniform dimensions, preferably five by four inches, with the circular field three inches in diameter.

(3) They shall be mounted on a blank sheet of loose-leaf notebook paper, appropriately labeled.

(4) They shall be accompanied by the following information on a separate sheet.

All possible material concerning the organism e. i. When discovered. By whom. Under what circumstances. Pathogenicity. Methods of culture. Isolating. Animal inoculation. Chemical composition. Efficacy of various methods of destroying and sterilizing. General description.

(5) To the candidate submitting the most complete series a suitable prize will be awarded. I would suggest a microscope, one of the best to be had, costing from $450 to $500.

This form can be used for various other crafts and sciences, such as chemistry, biology, pharmacy, wood-working, astronomy, mathematics, physics, electricity, and so on indefinitely.

I have chosen bacteriology as an example because it is to be (I hope) my profession.

J. G. Q.,
Hospital of Rockefeller Institute.
New York City.

(We would like to hear from other of our readers about the proposition outlined by J. G. Q.—Editor.)

Radio Star Viewed at New Televisor

MISS FLORENCE SHEA, selected as the most beautiful radio star in America, is shown here with the new General Electric Company's Televisor, recently displayed at the Radio Fair in New York. This television apparatus is the result of extensive experimentation and embodies all the improvements from the vast laboratory at this company's disposal. Several new features are included in this new apparatus. Six-stage amplification, a thirty-inch scanning disk and four large photo-electric cells comprise the essentials of this set. As you will notice, the set is more compact than the usual television set. The writer viewed this set in action and can say that it marks a decided improvement. The image obtained on reproduction was quite clear and about a foot square in size. This greatly enlarged image at the receiver is obtained by the use of a neon-crater tube placed behind the rotating scanning disk, which contains a spiral of lenses.

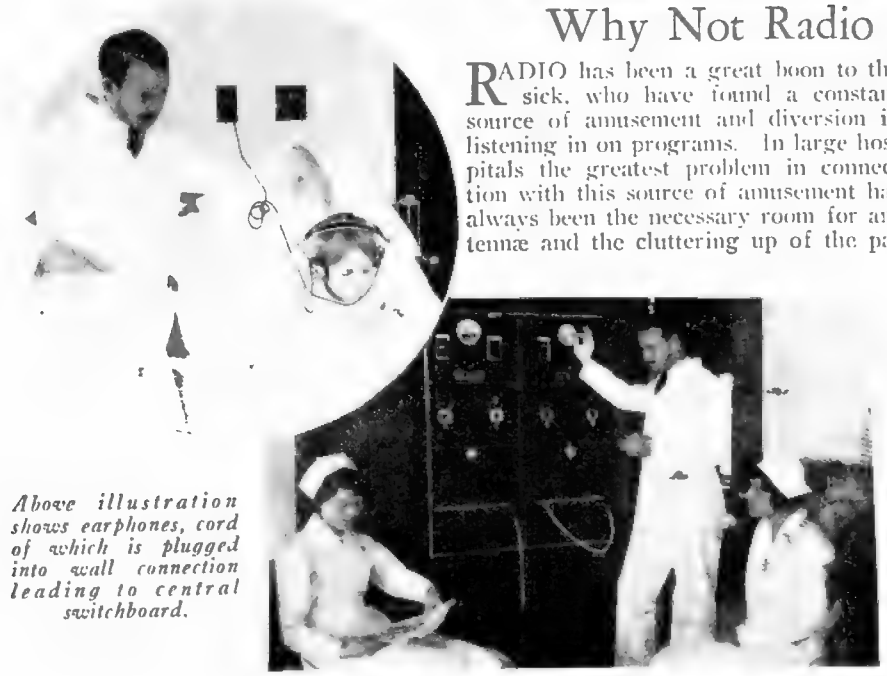
Radio Gives Us Television *and*

This Receiver Has "DX" Appeal

YES, it's a radio receiver that the good-looking girls are perched on—believe it or not! This large receiver was displayed at the recent radio shows to demonstrate that a receiver could be made to secure the finest selectivity and long distance reception, in spite of the many strong stations on the air and the closeness of the broadcast channels. It has four stages of tuned radio frequency and four stages of audio frequency. Incidentally it has a wave-length range of from 35 to 3,600 meters. The dials may be interlocked.

Why Not Radio for Every Hospital?

RADIO has been a great boon to the sick, who have found a constant source of amusement and diversion in listening in on programs. In large hospitals the greatest problem in connection with this source of amusement has always been the necessary room for antennæ and the cluttering up of the patients' rooms with many different sets. Now the Radio Corporation of America has come forth with an arrangement whereby the radio reception in a hospital, hotel, or any other large building with a number of outlets can be controlled from a central switchboard. This system employs only one antenna, has a choice of four broadcasting programs, and may have any number of outlets to the rooms throughout the building. The mixer and control panel may be operated very simply and requires no expert manipulation. The volume may be controlled at will, as well as the program selection. The patient has merely to signify his like or dislike of a program, and by means of jacks, similar to a telephone switchboard, any particular program of the four being received at that time may be sent through the wire leading to the outlet in the patient's room. In this manner the problem of amusement in such institutions has been considerably simplified.



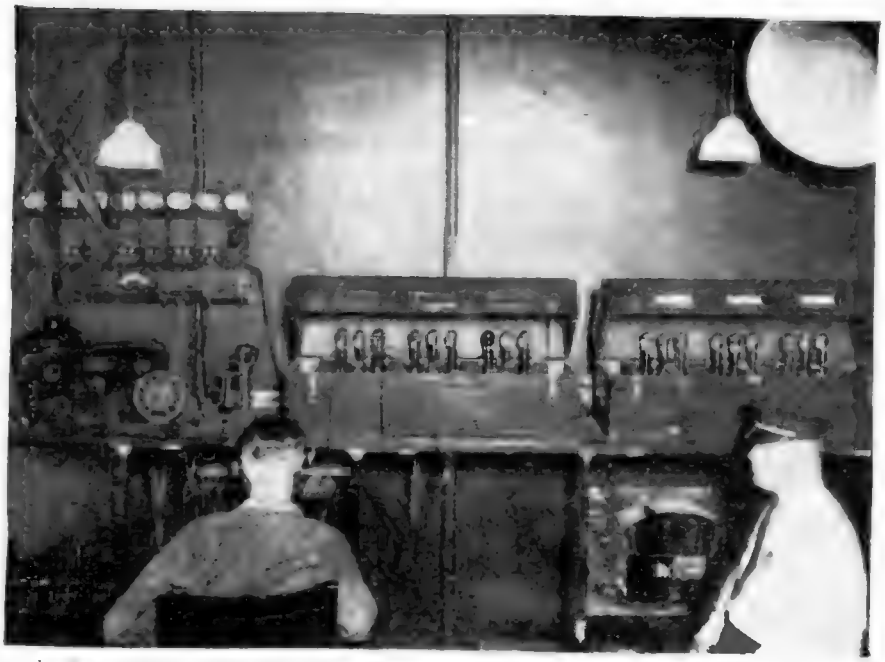
Above illustration shows earphones, cord of which is plugged into wall connection leading to central switchboard.

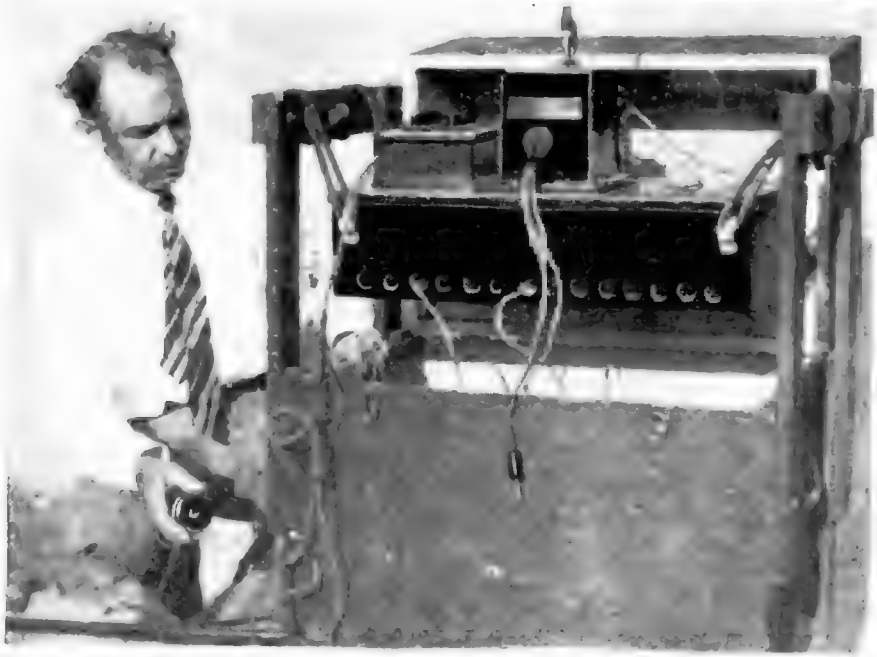
PHOTOS, MUSIC ALTITUDE INDICATOR

How High? Asks the Flier. Here's the Answer

THE recent success of the U. S. Navy with the automatic depth-finding instrument has prompted Leo P. Delasso of Los Angeles, California, to investigate the possibilities of such an instrument in commercial flying. He is shown in the picture below with his invention, which he calls a "sound frequency analyzer." The instrument which he hopes to perfect would automatically record on a dial the distance to the earth, a mountain or other solid objects for the information of pilots flying in the dark or fog.

Every Nice Jail Must Have Radio

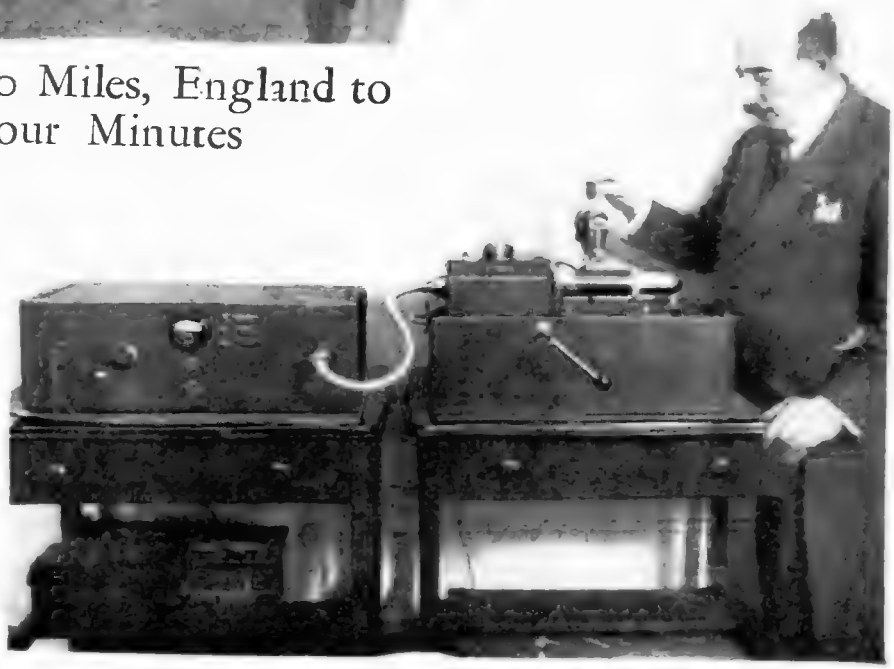




SING SING, the great gray collection of buildings on the Hudson River, home of New York's lawbreakers, has recently installed one of the most elaborate systems of radio receivers yet seen. The entire arrangement is the work of one of its inmates, an electrical expert, who is shown in the picture above in the central control room in Sing Sing. At the left of the picture is shown the commercial loop operated receiver. To the right are the two nine-tube amplifiers housing six push-pull amplifiers. The first three tubes supply 21 loud speakers, the next three supply 300 headphones, the next three 680 headphones, and so on for a total of 2,300 head phones. The receivers are wired in multiple series and so arranged that if some break down the rest of the system will continue to function. The system runs throughout the large number of buildings at Sing Sing.

Photos Radioed 14,000 Miles, England to Australia, in Four Minutes

A NEW radio transmitter which sends photographs, maps, or illustrations has recently been perfected by Captain Otho Fulton. This system may be used on radio transmission, on wireless telegraphy, or over telephone lines. One of the features of this instrument, which has already been adopted in practically every country in Europe for the sending of weather charts, maps, and the finger-prints of criminals, is that it is small and portable. The machine is nothing less than marvelous, needing only three and a half to four minutes to transmit a photograph—a photograph having been sent 14,000 miles in four minutes from England to Australia. At the right may be seen Captain Otho Fulton, perfector of the machine, alongside of this unusual instrument.



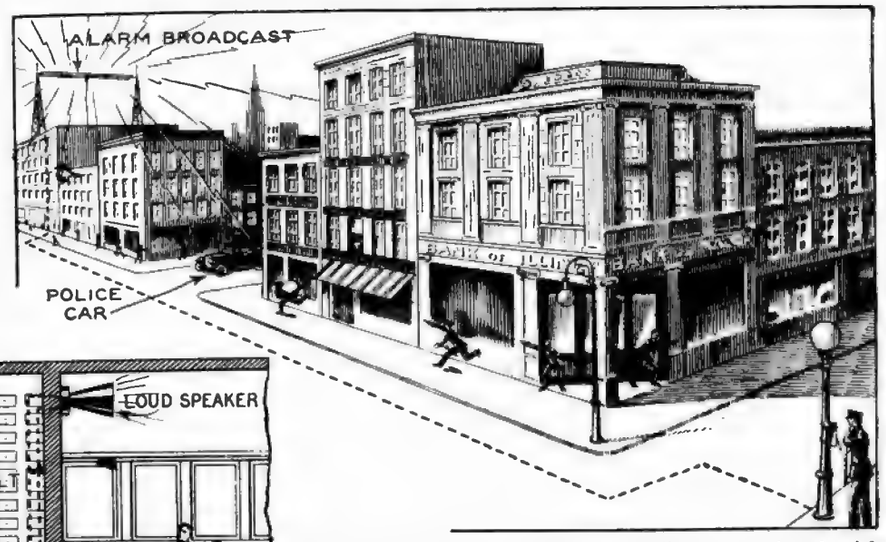
Chicago Police Use Radio to Outwit Outlaws

RADIO has become part of the present-day police force equipment. With the great increase in crime in the city of Chicago, officials of Station WGN offered the facilities of the station to the police in order to demonstrate that radio could advantageously be employed in catching criminals.

Police Cars

A NUMBER of automobiles were equipped with radio receivers, the antenna being placed in the roof of the car. The controls of the radio set were locked on WGN's wave length. So successful was the radio service that it is planned to extend its use over the entire city. When a call comes in to the station, the program is immediately interrupted and the police alarm broadcast to the automobiles, which then proceed at a fast rate to the scene of the crime. In order to broaden the service begun by Station WGN, the Police Department has obtained the use of the Naval Reserve Station NDS, which is situated on the north side of Chicago. In the near future it is planned to make the police broadcast on low wave lengths so as not to interrupt the regular broadcast programs and also to insure a certain degree of secrecy.

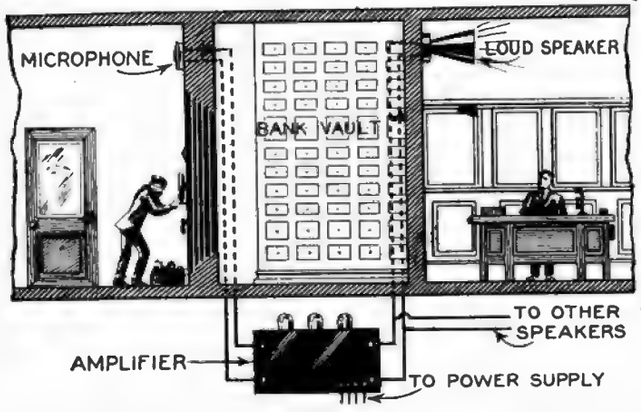
The above illustration shows a microphone installed in a bank vault. When used in conjunction with an amplifier, the slightest noise is made audible.



The illustration above shows a police car equipped with radio hurrying to the scene of a robbery after being notified of the crime from the broadcasting station. At the left is a bank vault radio installation, which promises to curtail any robberies in this direction.

Radio Watchmen

AN alarm system, consisting of a microphone, amplifier and



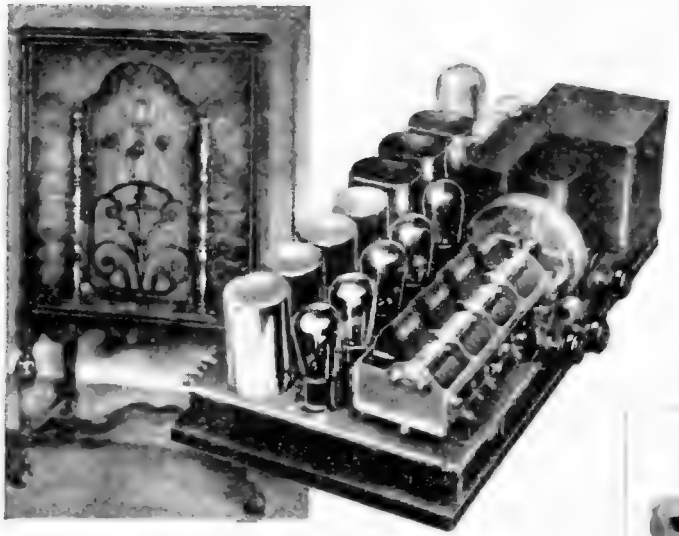
speakers, is now being installed in several bank vaults. The slightest noise in the vicinity of the vault will be amplified greatly, and, issuing from a loud speaker, will give warning to the watchmen on duty. A line might also be led from the bank to the nearest police station.

Radio-Equipped Cruisers

CREWS of the radio-equipped boats of the Detroit Police Department have made 96 arrests during the month of May, acting under orders broadcast from central stations. Since April 7, 1928, when the service was first inaugurated, 748 arrests were made. These arrests required 114½ minutes. The boats received 508 orders directing one or more to the place of the crime. Three hundred and nine messages, consisting of license numbers of stolen cars, missing persons and other police information, were also received.

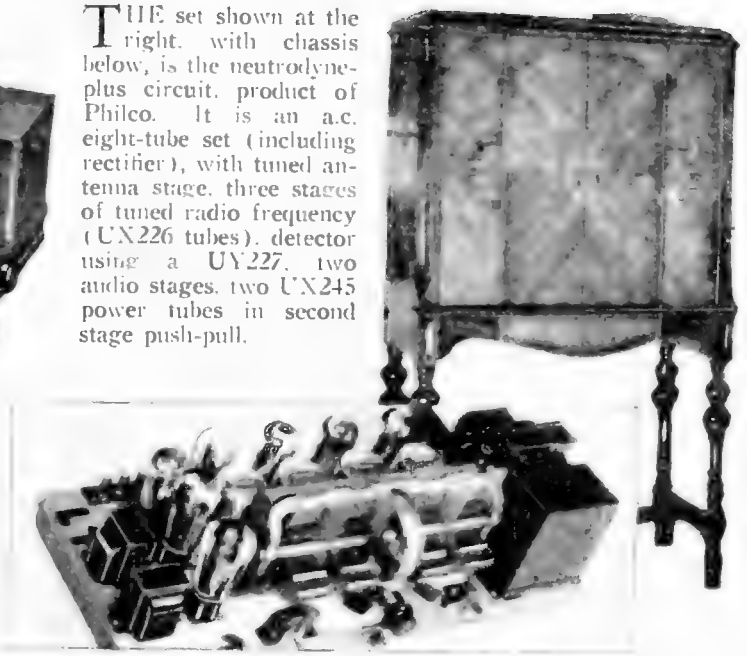
Several reports of the efficiency of radio as a police aid were recorded in the station logs during the month. In one instance a police boat received a call and learned that a man with a gun had been seen going into a store. In 30 seconds the boat arrived at the scene and the man was arrested. Two men were arrested by the crew of another station cruiser 19 seconds after the police had been notified that they were breaking into a store. Several instances of car stripping were reported to the police, and in three cases the cruisers arrived in time to arrest the thieves. One of the runs was made in 60 seconds, another in 90 seconds and the third in 2 minutes.

The cities of Detroit and Chicago have been pioneers in the use of radio for man-hunting purposes. It is expected and hoped that other cities will follow suit and equip their police departments with radio so that photographs and fingerprints can be quickly radioed from one city to another.



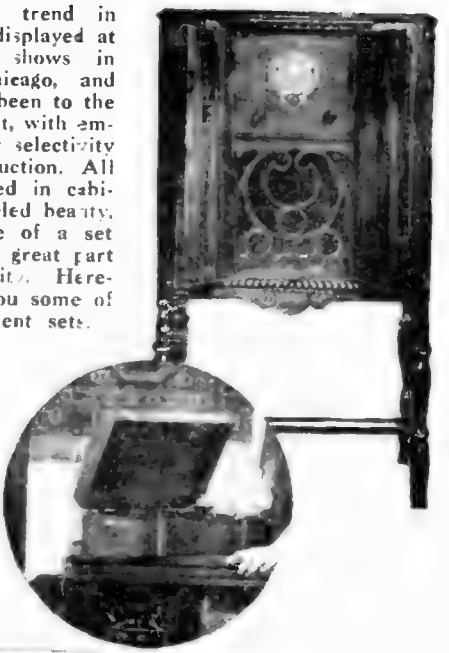
ABOVE is shown a new nine-tube a.c. receiver, manufactured by Brunswick. It has three tuned radio-frequency stages and a tuned detector, all using heater type tubes; a socket power unit using a heater type tube for the first audio and two UX245 tubes in push-pull for the power stage. A 280 double-wave rectifier tube and a voltage regulator tube complete the unit.

THE set shown at the right, with chassis below, is the neutrodyne-plus circuit, product of Philco. It is an a.c. eight-tube set (including rectifier), with tuned antenna stage, three stages of tuned radio frequency (UX226 tubes), detector using a UY227, two audio stages, two UX245 power tubes in second stage push-pull.

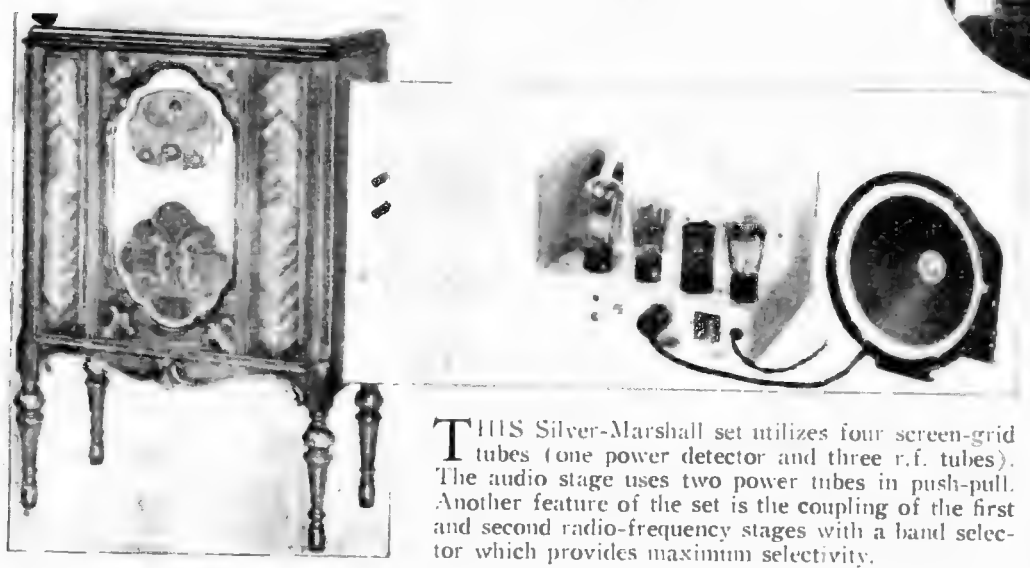


NEW RADIO SETS

THE recent trend in radio sets displayed at the radio shows in New York, Chicago, and Washington has been to the screen grid circuit, with emphasis on greater selectivity and better reproduction. All of them displayed in cabinets of unparalleled beauty, the selling value of a set seems to rest in great part on the last quality. Herewith we show you some of the most prominent sets.



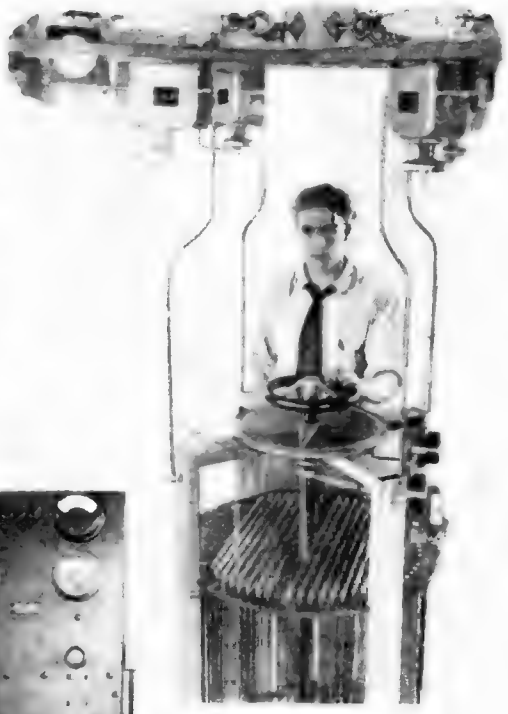
ONE of the latest screen-grid sets, an inexpensive one, is shown above. It is the unitrad circuit product of Crosley, utilizing eight tubes, including three 224 screen-grid radio frequency tubes. A special feature of the set is a range control, which provides a greater control of volume with minimized distortion. The set is obtainable with or without cabinet legs



THIS Silver-Marshall set utilizes four screen-grid tubes (one power detector and three r.f. tubes). The audio stage uses two power tubes in push-pull. Another feature of the set is the coupling of the first and second radio-frequency stages with a band selector which provides maximum selectivity.

THE above is the Columbia a.c. eight-tube set shown with a portable phonograph and electric pick up. It uses four heater type tubes (in the four r.f. tuned stages) and two power amplifier tubes in the audio push-pull output. Single dial control and complete shielding are among its features. A plug-on connecting cable or a radio-phono link may be used. The feature of the combination is the selector tuner, which permits instantaneous tuning in of any eight stations on the dial.

Radio "Eye" to Guide Planes



EXPERIMENTS with a low power visual radio beacon are now being made, in an effort to aid flyers in finding flying fields during fog and at night. To make use of the new system an airplane need only to be provided with a small receiving set carrying an indicator which tells when the aviator deviates from his course. These experiments are being carried on at Mitchel Field, Long Island. The airplane used in the experiments is shown. This plane has the new type vertical antenna.

William D. White, Chief Operator, is shown setting a course on the goniometer at Mitchel Field's new radio beacon. It lays a course for planes within five hundred miles.

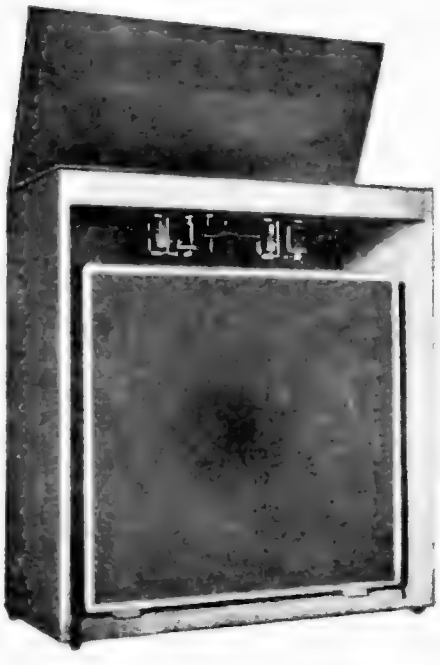
As the receiving indicator in the airplane is of the visual type, it is not necessary for the aviator to wear head phones and signals may be received without fear of interference from engine noises. This device should be a great aid to both commercial and military flyers.

The indicator may be installed on the instrument board in front of the pilot, where it will be most convenient.

How to House Airplane-Cloth Speaker

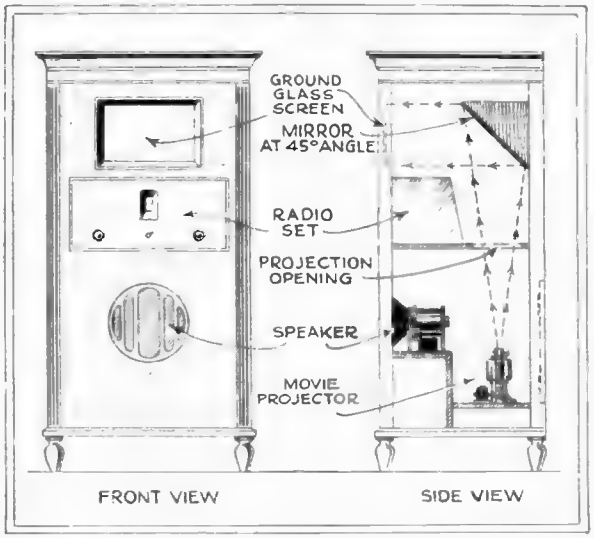
THE two photos illustrate a novel method of enclosing the popular airplane cloth speaker in a console. The speaker is set in the lower part of the cabinet and covered with an ornamental grill work. The radio set is placed in the upper part of the cabinet and is adjusted from the top. Auxiliary apparatus such as the power device and amplifier are placed behind the speaker.

Such an arrangement offers a useful suggestion to the radio listener who prefers the airplane speaker to the dynamic type speaker. In making the cabinet for this speaker it would be well to keep in mind that it should be sturdily constructed to prevent parasitic vibrations. Parts of the set should also be mounted so that they do not vibrate. A phonograph turn-table and pick-up can be easily mounted on the top panel, making a phonograph-radio combination. Excellent quality of reproduction will result with this arrangement.



Movies and Radio from One Console!

THE diagram below shows how an attractive radio set and motion picture projector combination may be installed in the same cabinet. The radio set and loud speaker may be any popular type. A novel use of a mirror and ground glass screen is made in the arrangement for projecting motion pictures. As is shown, the pictures are reflected from the mirror to the ground glass opaque screen. Radio programs may be tuned in as an accompaniment to the picture being shown. Thus two modern inventions are combined in one attractive cabinet.



Dry Rectifiers

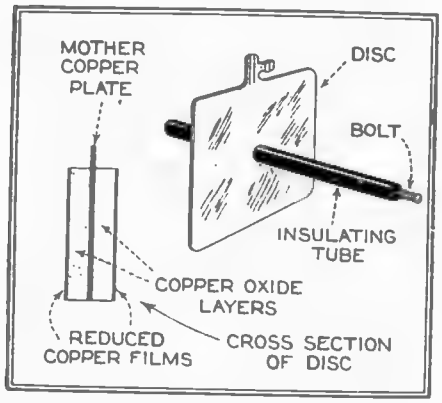
(740) John M. Rogers, Schenectady, N. Y., writes:

Q. 1. Will you please describe the different types of dry rectifiers now in use?

Q. 2. Please give diagram of how to connect the separate plates of such a rectifier to the secondary of the single transformer?

A. 1. There are two dry rectifiers on the market, the first is the so-called copper sulphide plate (which depends on the formation of a film by electro-chemical action); the second is the copper oxide type. The latter does not depend on any chemical reaction for its rectifying property; therefore, it probably will last much longer.

The first copper oxide rectifiers to be manufactured consisted of two discs per element, a "mother" copper disc, a copper oxide layer, and a lead washer. These rectifiers when used in radio sets and for other commercial uses were very bulky, and consequently some improvement was needed. The Kuprox rectifier is the copper oxide rectifier which is most commonly used at present. As shown in the drawing, in this column, the plate consists of the central "mother" copper plate enclosed by a layer of copper oxide and metallic copper. This plate is a complete rectifying element and



Above illustration shows construction of elements of copper-oxide rectifier.

is only 0.25" thick. This rectifier is very efficient, and does not deteriorate for a very long time.

The copper sulphide rectifier consists of five separate and distinct parts; a copper or brass radiating plate, a soft lead washer, copper sulphide disc, magnesium disc, and a lead washer. This rectifier is quite as efficient in the quality of current supplied, but due to electro-chemical reactions, it degenerates in a very short time.

A. 2. The best way, and, incidentally, the way these rectifying elements are connected in commercial rectifiers, is in series parallel. The diagram of such a connection is shown here. You will notice that 12 Kuprox discs are used to obtain full-wave rectification from the single transformer secondary. The same connection may be used in the sulphide type of rectifier except that two 8 element units must be used to obtain the same output.

Bulb Testing

(741) James C. Wilby, Minneapolis, Minn., writes:

Q. 1. Could you please tell me some simple way of testing radio tubes? I have seen diagrams in many of the service bulletins, but they are all rather complicated.

A. 1. We have recently run across a very

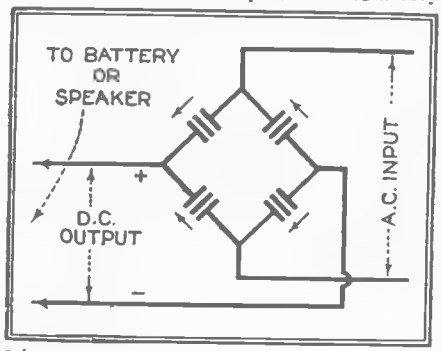


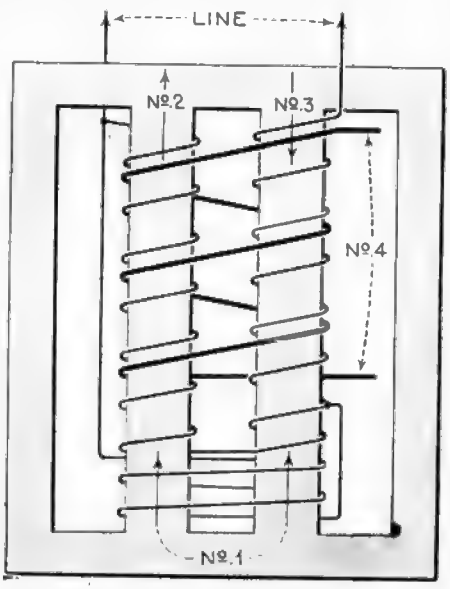
Diagram shows 12 copper-oxide plates connected in series-parallel.

simple means of testing radio tubes in the current issue of *Radio*. On the right is seen a diagram of the testing apparatus. If the tube is in perfect condition, lamp 3 should light on placing the tube in the socket. Lamps 1 and 2 should remain unlit. If lamp 1 lights, it shows that the grid and filament are touching. If lamp 2 lights, it indicates that the grid and plate are touching. A simple and sure means of relieving these situations is to gently tap the tube in the palm of the hand; this will often separate the elements.

Voltage Regulator

(742) Lester J. Ochs, Tampa, Fla., writes:

Q. 1. I have heard recently of a power transformer which is used as a voltage regulator. Will you please describe it and its actions.



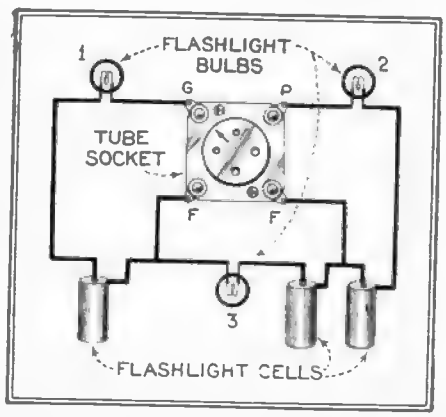
Windings of voltage regulator transformer.

A. 1. This instrument is known as the Potor and replaces the old method of resistor—transformer arrangements, and the use of adjustable taps on the transformer primaries. This instrument is very sensitive and in commercial form the windings are arranged so that any voltage may be controlled in the output.

It consists of four windings instead of the usual two: the primary, the additive, the subtractive, and the secondary windings. The coils are so connected that the flux paths of core windings No. 1 and No. 2 are in the same direction and that the flux path of core winding No. 3 is in the reverse direction.

At a predetermined low voltage point, the ampere turns of winding No. 2 should be such that the section of the core surrounded by this winding will be operating upon the upper knee of the saturation curve, while at this same voltage the flux in the core surrounded by winding No. 3 should be balanced out.

It is necessary in fulfilling this condition to take into consideration both the flux generated by the primary, No. 1, which is in the same direction as that generated by the core winding No. 2, and the reverse flux generated by the counter E. M. F. of the secondary, No. 4. The flux generated



Layout of flashlight lamps, batteries and socket for testing radio tubes.

by the secondary is in the same direction as that generated by core winding No. 3. Note, too, that the primary current through winding No. 1 also flows through a portion of winding No. 3.

With these factors taken into consideration, and the design made accordingly, at low line voltage the flux generated in core winding No. 3 is balanced out and consequently there is no voltage drop across the tapped section, No. 3-A, of winding No. 3. The primary, No. 1, therefore has full line voltage impressed across it. The secondary voltage under these conditions will depend upon the number of turns and the flux density of the core surrounded by winding No. 2.

At this point the circuit will show some regulating properties, even though the flux in the core surrounded by winding No. 3 be in balance, as the core surrounded by winding No. 2 is now working on the knee of the iron saturation curve and a large increase in ampere-turns is required for a small increase in flux density. Added to this regulating action is the reverse flux in the core surrounded by winding No. 3.

Scientific Humor

NOTE-ING DOING

1ST BOY—What's a quire of paper?

2ND BOY—Choir of paper? Oh, it must be one of those music rolls for a player piano.—*William Tindale.*

FOR ZOOMING AVIATORS

FIRST STUDENT (in the city)—What are those things sticking out from the sides of that sky-scraper?

SECOND STUDENT—Oh those are mile posts.

—*Frank Hohn, Jr.*

SHOULD ASK FOR CARRIER PIGEON

It was a cold February morning and the sheriff had gone to the cell of Mose Jackson who was to be hung the next day.

"For your last meal you can have anything you want and as much of it as you want," said the sheriff. "What would you like, Mose?"

"Ah believe Ah'd lak a nice watermelon," replied Mose.

"But watermelons won't be ripe for 6 months yet," said the sheriff.

"Ah kin wait, boss. Ah kin wait," replied Mose eagerly.

—*Mrs. H. E. Chrisman.*

LEFT SPOT OF INTEREST

POP—Did your son go through college?

BANG—Not quite. He took a chemistry course and only went as far as the roof.

—*Juanita Cunningham.*

OUT OF SHAPE

A man had just visited the zoo for his first time. Upon seeing a camel, he exclaimed, "My but that horse is warped."

—*Early L. Newell.*

YOU NEVER SEE A FISH

First Prize—$3.00

"Light rays are refracted when they enter or leave water. This property shows that you do not see a fish where it is; and as you cannot see a fish where it is not, therefore you do not see a fish at all."—*K. Subramoney.*

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

WELCOMED DEATH

The after-dinner speaker droned on and on. One diner after another yawned and nodded, one finally resting his head on the table. Leaning over, the chairman tapped him on the head with his gavel. The delinquent raised his head a little.

"Hit me again and harder," he said, "I can still hear him."

—*Mrs. H. E. Chrisman.*

UNSIGHTLY

JOHNNY—Teacher, can bacteria see?

TEACHER—Why do you ask such a foolish question?

JOHNNY—I heard that some bacteria are cock-eye (cocci).—*M. Zykofsky.*

GRAVITY DEFIED

GYM COACH—Lift up your left legs and hold them straight out in front of you.

A freshman held up his right leg by mistake. This brought his right and his companion's left leg close together. The coach on seeing this exclaimed: "And who is that galoot over there holding up both legs?"—*Juanita Cunningham.*

A VACUUM IN THE WRONG PLACE

PHYSICS PROFESSOR—If you should drop a lead ball and a feather from the top of a building at the same time, which would hit the ground first?

STUDENT—The lead ball.

PROFESSOR—Is there anything that would make both touch the ground at once.

STUDENT—Tie the feather to the ball.

—*Elmer Paulson.*

GOLIATHS

TEACHER—Do people eat whale meat?

JIMMY—Yes, M'am, they do.

TEACHER—What is done with the bones?

JIMMY—They put them on the side of the plate.

—*Leo Packer.*

A PSYCHIC PHENOMENON

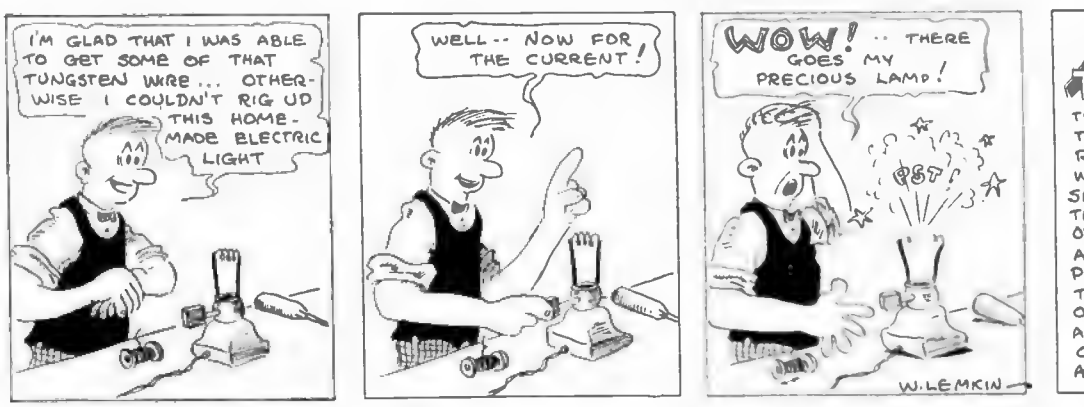
A man and woman accidentally touched each other's feet under the table.

"Secret telegraphy," said he.

"Communion of soles," said she.

—*Frank Shymko.*

Scienty Simon—*Scientist*


I'M GLAD THAT I WAS ABLE TO GET SOME OF THAT TUNGSTEN WIRE... OTHERWISE I COULDN'T RIG UP THIS HOME-MADE ELECTRIC LIGHT
WELL-- NOW FOR THE CURRENT!
WOW! .. THERE GOES MY PRECIOUS LAMP!
PSST!
W. LEMKIN
SCIENCE LESSON NO. 38
THE FINE TUNGSTEN FILAMENT IN AN ELECTRIC BULB IS HEATED BY THE CURRENT UNTIL IT REACHES THE POINT OF WHITE-HOT INCANDESCENCE. SHOULD ANY AIR BE PRESENT, THE THIN WIRE WOULD BE OXIDIZED AND CONSUMED ALMOST INSTANTLY ... TO PREVENT THIS, NEARLY ALL THE AIR IS PUMPED OUT OF THE BULB, CREATING AN ALMOST PERFECT VACUUM, OR ELSE IT IS FILLED WITH AN INERT GAS LIKE NITROGEN

Change in Boiling Point at Different Altitudes

(2337) Harold D. Johns, El Paso, Texas, asks:

Q. Is it true that altitude or depth pressure may be calculated from the lowering or raising of the boiling point of water?

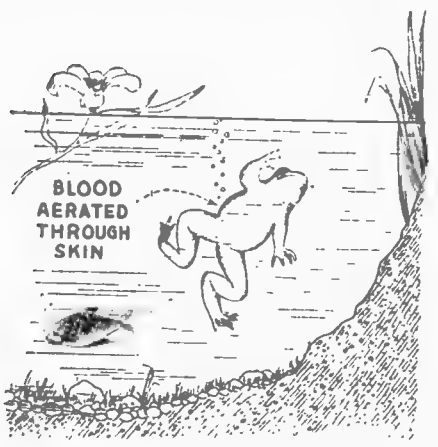
A. This is quite true, and the method used for calculating this is very simple. The normal point of distilled water is 100 degrees Centigrade or 212 degrees Fahrenheit at sea level (760 mm pressure approximately). An instrument called the hypsometer may be used to determine any abnormal pressure shown by a change in boiling point. This instrument shows that an elevation of 543 feet produces a change of 1 degree Fahrenheit in the boiling point of distilled water. This instrument is only for laboratory use, as it is quite delicate. The water used must be distilled, for impurities would raise or lower the boiling point without there being any change in atmospheric pressure.

How Does a Frog Breathe?

(2338) Frank Chamberlin, Jersey City, N. J., writes:

Q. If a full-grown frog is supposed to be an air-breathing animal, how is it possible for him to hibernate in the mud during the winter, or remain under water for any length of time?

A. The frog is enabled to remain under water for a long period of time for the same reason that most amphibians can; mainly that his lungs are not utilized under water in actual breathing. Much of the oxygen used by the frog is taken in through his skin. If one should dissect a frog he would find the lungs very small in comparison to the rest of the visceral organs. The thigh region of the frog is particularly suited for the absorption of oxygen. Here the air filters through moist membranes and reaches the blood stream. If the skin of the frog becomes very dry, he will suffocate, for the air will not pass through a dry membrane; that is the reason frogs usually select moist neighborhoods for their summer singing-fests.



How a frog breathes under water is shown above. The air filters through the moist membranes in the skin of the frog and thus reaches the blood stream.

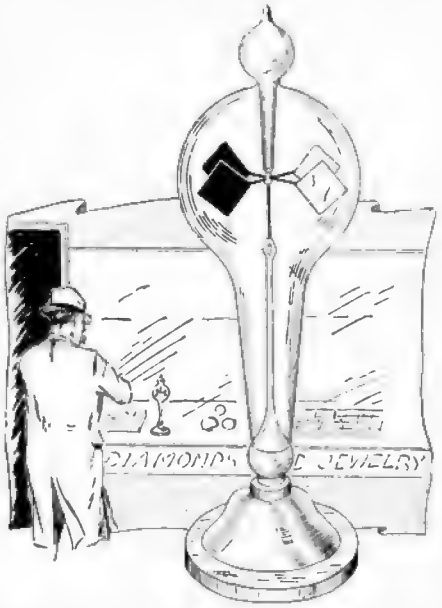
Frogs are able to endure prolonged submergence because the blood can be aerated through the skin from the surrounding water.

The Oracle

Does Electric Charge Affect a Radiometer

(2339) Miss Rowena Klein, New York City, writes:

Q. Why does a rubber rod charged with frictional electricity repel the blackened sides of the vanes of a radiometer, while it attracts material like small pieces of paper?



The radiometer is shown above with the blackened portions of the vanes and also the polished sides.

A. The Crookes radiometer, which is the most familiar form of this instrument, consists of four mica vanes carried on cross-arms and the little mill wheel as it may be called revolving on a pivot. These vanes are polished on one side and coated with lampblack on the other. The glass bulb in which they rotate has practically all the air exhausted from it. When ether waves pass through the glass, from some external source of heat or light, they strike the polished surfaces and are reflected. If they strike the blackened surfaces, the heat is absorbed, and the temperature of the few molecules of gas left in the bulb is raised. These molecules of gas hit the glass and rebound, giving the vanes a rotating movement. When we received the question mentioned above, we concluded that if such a phenomenon as our reader mentioned had occurred, it was due to the large amount of heat generated in creating an electrostatic charge on the rubber rod. For a final authority on the matter we consulted Dr. E. E. Free, noted engineer of New York City, and he gave us the following answer:

It is not true that an electrified rubber rod ordinarily repels the vanes of a Crooke's radiometer. On the contrary such an electrified rod always attracts these vanes, as it should do on electro-static theory, unless some disturbing factor such as a large amount of heat or light radiation strengthens the normal movement of the radiometer vanes enough to overcome the force of magnetic attraction. To be sure that the vanes were attracted by the charged rubber rod, I performed this experiment and found that there was no repulsion of the vanes.

Lead Ball or Feather Falls Faster?

(2340) S. G. Roemer, Palto Alto, Calif., writes:

Q. Do all bodies, regardless of weight, fall with the same velocity.

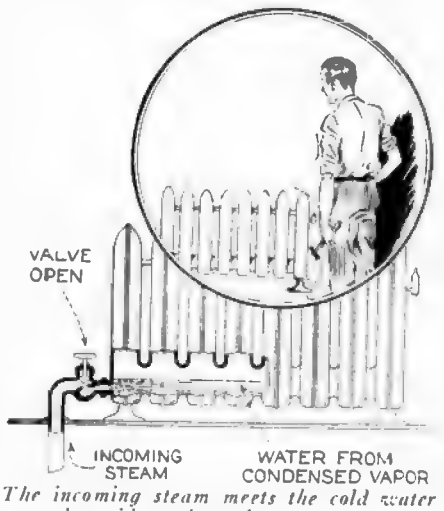
A. This question is easily answered by the classical experiment of Gallileo in his work with compact bodies of unequal weight. He found that all bodies would fall with the same velocity, if they were of different weights but compact in size. If they were not compact, he found that a certain amount of air resistance would enter into the experiment, and the bodies would not fall with the same velocity. A feather and a lead ball fall side by side in a vacuum.

Why Steam Radiators Hammer

(2341) John Duffy, Pittsburgh, Pa., inquires:

Q. What causes radiators to bang and become very noisy? Is there any means of stopping this?

A. This seems to be the universal question at this time of the year, for everyone knows of the nerve-wracking noise caused by the radiator as soon as the steam valve is opened. This is particularly noticeable in the morning, after the radiator has been subjected to the cool night breezes. It is caused by the steam coming in contact with the cold condensed water in the radiator. When the valve is opened the steam rushes in, it meets the cold water and a rapid condensation takes place which pushes the water violently against the sides of the radiator, causing that clanking noise which is known as water-hammer. One way of obviating the trouble is to open the steam valve very little and allow the steam to gradually filter into the radiator.



The incoming steam meets the cold water and rapid condensation takes place.

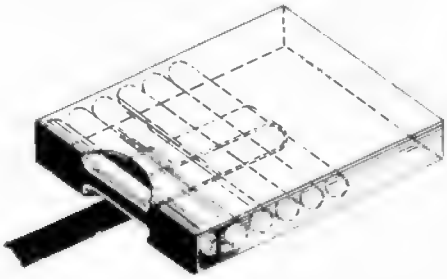
Latest Patents

Loud Speaker

No. 1,718,354, issued to M. R. Hutchison, Jr. The object of this cleverly designed radio loud speaker is to provide a compact and comparatively inexpensive instrument with increased power and volume of sound throughout an exceptionally wide range of frequencies. This is accomplished by means of a large number of eccentrically arranged horns, or air-chambers, increasing systematically in length from a common central opening to the outer periphery, giving progressive lengths for resonance.

Cigarette Package

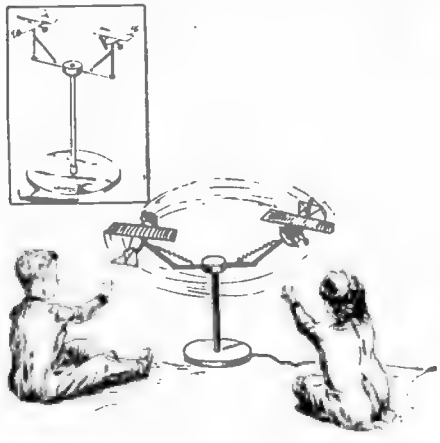
No. 1,718,572, issued to M. M. Marcuse. This package is designed to provide for the delivery of one cigarette at a time until the package is emptied. A tape, made of paper



or other suitable material, is fastened at one end to the interior of the package, passes over and around the cigarettes, and has the other end projecting at the end of the package provided with an outlet. Pulling on the tape will bring a cigarette to the outlet.

Airplane Toy

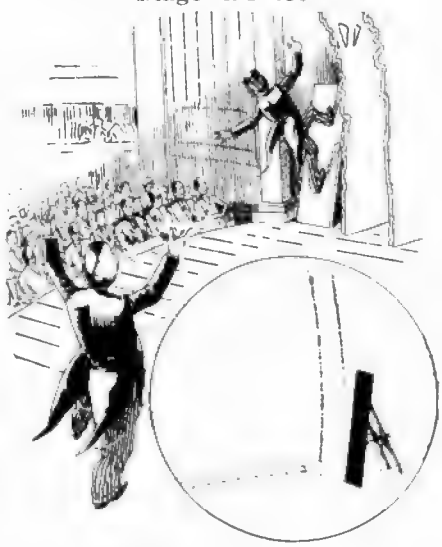
No. 1,722,922, issued to J. C. Johnson. The two toy planes, mounted on the end of arms, when moving in a circular path, will swing outwardly under the action of centrifugal force, constantly remaining in a horizontal position. They may be operated by motor-driven propellers or by a single motor rotating the supporting stand.



Notice to Readers:

AN appreciable period of time elapses between the filing of a patent and the date upon which the patent is granted. During this interval inventors frequently move. We regret that it is quite impossible for us to supply the correct addresses of persons whose inventions appear on this page, nor can we furnish information about when the product may appear on the market. Attorneys who prosecuted the patent cases can furnish the most reliable data. Copies of patents are available at ten cents each from the U. S. Patent Office, Washington, D. C.

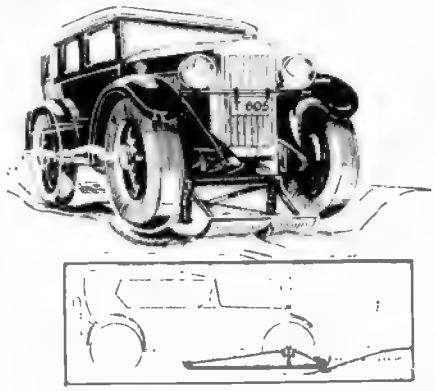
Stage Device



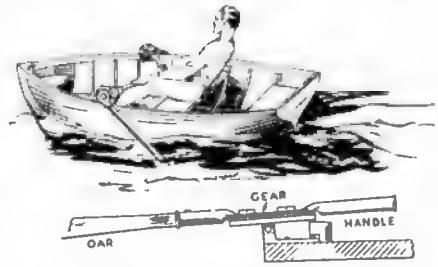
No. 1,708,159, issued to Stewart S. Sawyer. This invention relates to a portable vertical platform, to be temporarily set up just back of the proscenium arch in a theatre. Its purpose is to permit the performer to run up it to do a somersault or back flop.

Auto Snowshoe

No. 1,699,430, issued to William J. Heinzel. Often, when driving over snow-covered roads, hard drifts of snow are encountered and the front wheels of the auto are forced into the drift, with the result that the rear traction wheels are unable to



push the car through the obstacle. The snowshoe illustrated is designed to eliminate this inconvenient stalling. This shoe is adapted to be supported under the front axle to lift the front of the car over encountered drifts. Being placed a predetermined distance above the ground, this device will operate only when drifts are encountered. A guide rib is provided along the bottom of the shoe.

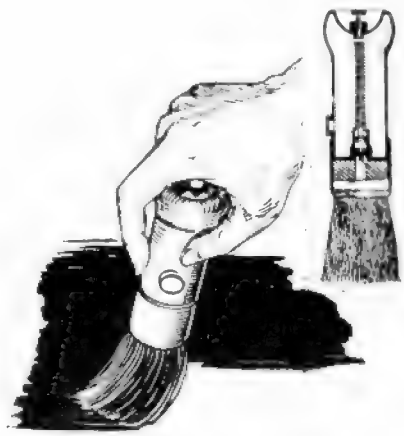


Boat Rowing Device

No. 1,704,074, issued to C. A. Bilestine. Ordinarily, when rowing, one must sit backward to the prow of the boat, resulting often in a collision or a miscalculation of direction. This novel invention permits one to face the direction the boat is being rowed. Intermeshing gears cause the rearward movement of the oars by the rearward motion of complemental handles. The illustration clearly demonstrates this principle. By pulling on the handles, the oars are forced backward, propelling the boat forward.

Fountain Brush

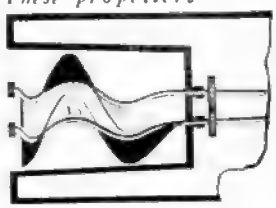
No. 1,704,224, issued to John J. Sitkin. A plunger projecting from the head of this brush forces the contents of the refillable hollow handle into the brush. This principle can be readily applied to paint, shav-



ing, paste brushes and the like. Means is provided to prevent the return of the discharged contents. The plunger is operated by the pressure of the person using the brush.

Boat Propellers

No. 1,713,448, issued to William J. Roe. These oppositely driven propellers, having oppositely spiraled internested shafts and blades, are adapted for use on what may be termed surface watercraft, such as hydroplanes, which, when their maximum speed is attained, have such a shallow draft as to practically skim or glide over the surface of the water. These propellers



are designed to eliminate a rudder with its resistance, ordinarily required when standard propellers are used.

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You Can Make These

Illuminated Table Decorations

By Josef W. Von Stein

(*Continued from page* 803)

equipped with gelatin color screens, will be needed for floodlighting wall areas.

Most useful for all table decorations and many of the room decorations are the strings of small lamps known as Christmas tree sets. Several types are available. One a 15-volt lamp, is known as the series lamp which must be used either with a small transformer or wired in series in groups of eight. The lamps and sockets being very small, they lend themselves admirably to table decorations. Nevertheless, they offer somewhat of a disadvantage in that the failure of one lamp extinguishes the entire group.

Crepe paper of many hues is the chief material. Fashioned in countless ways, and combined with small amounts of colored light their beauty is magnified to such an extent that practically all lighted table effects will be found to be merely adaptations of the familiar crepe paper forms to include lamps and wiring in their make-up.

Heavy cardboard is useful, not only in foundations for some paper decorations, but also in making bases for the decorations to stand upon.

Fine spool wire and paste serve as the binders holding together the wiring devices and the paper decorations. Heavy cotton covered supporting wire is necessary where it is desired to have the socket stand upright. Fiber candle husks, balloons and inflated rubber toys all have their places in the general layout. Thumb tacks and pins are essentials to festoon the room and table.

Small illuminated figures, with faces painted on the bulb lamps, can be used at all times.

Another type is known as the multiple Christmas tree lamp. This 10-watt, 110-volt lamp, while slightly larger than the foregoing, may be burned singly or in groups wired in multiple on a single cord. They have the advantage in that any number may be used in a group, and the failure of one lamp in no way affects the other lamps in the decorative scheme.

A third type of lamp, and one that will no doubt be used more than any other, is the 10-watt, 110-volt lamp which was designed for decorative and sign service. This lamp has a decided advantage over the other types, particularly in cases where the decorations are to be relatively permanent, as it is designed for longer life than the Christmas tree lamp.

Papers and Accessories

THE materials out of which the actual decorations are constructed consist largely of colored and fancy papers. Occasionally a translucent neutral background, on which color effects can be built, is desired, as in the case of lanterns for garden parties. A heavy grade of manila paper, oiled with boiled linseed oil, serves excellently. The paper is pasted or sewn on a light framework of wood or wire.

All these decorations are built directly about the lamps, and the method of wiring or assembling will be determined by the type of decoration.

Christmas Table Lighting

BESIDES the garnishing of the Christmas tree, we are growing familiar with twinkling wreaths, candle lighted windows, festooned entrances, and even floodlighted exteriors. The play of imagination will produce fascinating effects for the table far more original than the lighted tree.

A center table decoration may be made of a 10-inch ball-shaped wire frame covered with crushed white crepe paper. Through a small opening in the bottom is inserted a string of red Christmas tree lamps, the entire lamp and socket being in turn forced through the paper wall so

(*Continued on page* 832)

In AMAZING STORIES For January

BEYOND THE GREEN PRISM, by A. Hyatt Verrill. (A serial in 2 parts.) Part 1. Few stories have elicited warmer praise from our readers than "Into The Green Prism," and the author has nobly answered the call for a sequel in which, incidentally, all scientific "flaws" are taken care of—so the author says. As all good sequels should do, this one far excels the original story.

AIR LINES, by David H. Keller, M.D., It is to be expected by this time that Dr. Keller will inject an original twist and surprise element in a story that deals with any subject. Aviation is no exception to this rule. And yet the future that this well-known author predicts for air travel is not beyond the realm of possibility.

WHEN THE ATOMS FAILED, by J. W. Campbell, Jr. Although Mr. Campbell is a new author and an extremely young man as authors go, he gives us an interplanetary story of excellent merit, in which a goodly amount of interesting science is ingeniously interwoven to make a romance of startling plausibility. We predict a great following for this author in the field of literature and particularly scientific fiction.

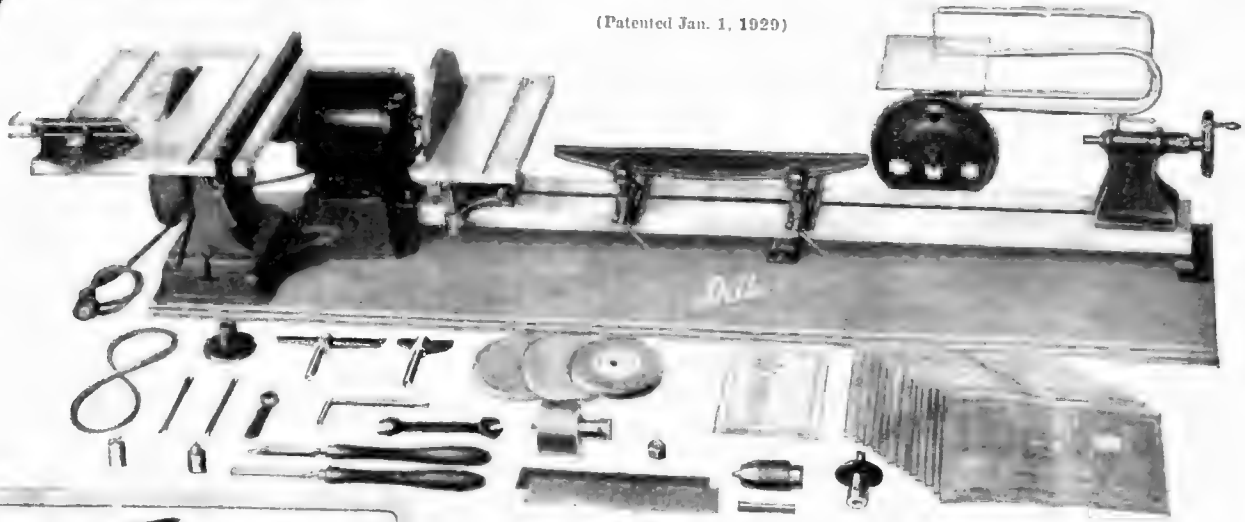
THE SWORD AND THE ATOPEN, by Taylor H. Greenfield. The opening of this story will carry a strong appeal to victims of that most miserable of our minor troubles—hay fever. It is a tale dealing with the subject of chemistry—a subject which is rarely treated, probably because it requires more definite knowledge, which must be obtained by actual study, than do most subjects.

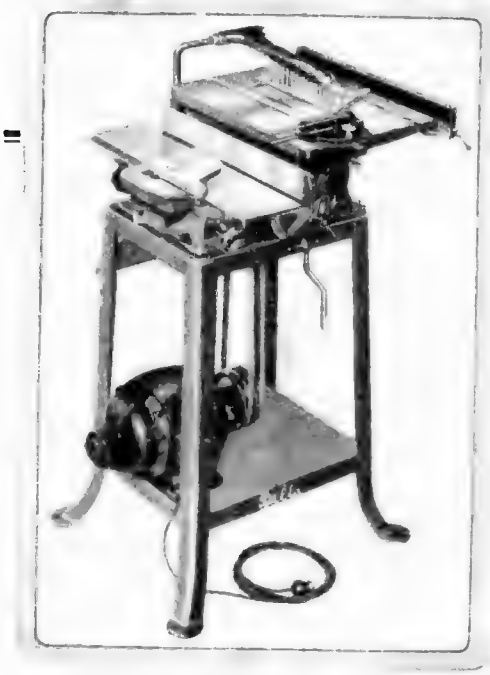
THE FOURTH DIMENSIONAL SPACE PENETRATOR, by Julian Kendig, Jr. Here is another unusual tale dealing with that most baffling of subjects—the fourth dimension. This time the author employs the planetary atom in a most interesting manner, for aid in building the yarn. We can assure you ten minutes of fascinating reading.

And several other stories, for which purpose we have added 16 more pages to the magazine.

Announcing— The New "1930" Models "Delta" Woodworking Units

(Patented Jan. 1, 1929)





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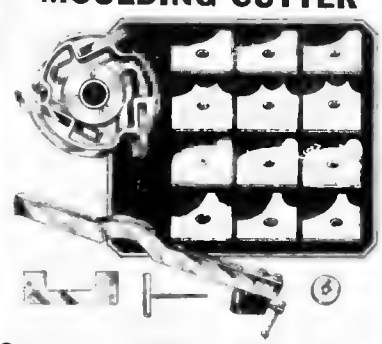

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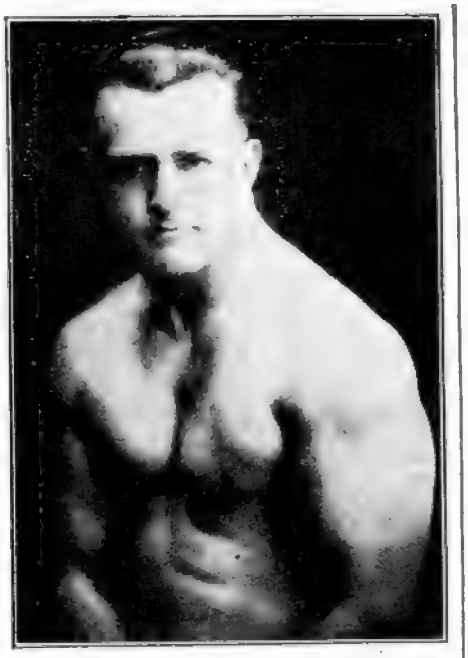

EARLE LIEDERMAN, "The Muscle Builder"

Author of "Science of Wrestling," "Muscle Building," "Here's Health," "Secrets of Strength," "Endurance," etc.

If You Were Dying To-night

and I offered you something that would give you ten years more to live, would you take it? You'd grab it. Well, fellows, I've got it, but don't wait till you're dying or it won't do you a bit of good. It will then be too late. Right now is the time. Tomorrow or any day, some disease will get you and if you have not equipped yourself to fight it off, you're gone. I don't claim to cure disease. I am not a medical doctor, but I'll put you in such condition that the doctor will starve to death waiting for you to take sick. Can you imagine a mosquito trying to bite a brick wall? A fine chance!

A RE-BUILT MAN

I like to get the weak ones. I delight in getting hold of a man who has been turned down as hopeless by others. It's easy enough to finish a task that's more than half done. But give me the weak, sickly chap and watch him grow stronger. That's what I like. It's fun to me because I know I can do it and I like to give the other fellow the laugh. I don't just give you a veneer of muscle that looks good to others. I work on you both inside and out. I not only put big, massive arms and legs on you, but I build up those inner muscles that surround your vital organs. The kind that give you real pep and energy, the kind that fire you with ambition and the courage to tackle anything set before you.

ALL I ASK IS 90 DAYS

Who says it takes years to get in shape? Show me the man who makes any such claims and I'll make him eat his words. I'll put one full inch on your arm in just 30 days. Yes, and two full inches on your chest in the same length of time. Meanwhile, I'm putting life and pep into your old backbone. And from then on, just watch 'em grow. At the end of thirty days you won't know yourself. Your whole body will take on an entirely different appearance. But you're only started. Now comes the real works. I've only built my foundation. I want just 60 days more (90 in all) and you'll make those friends of yours who think they're strong look like something the cat dragged in.

A REAL MAN

When I'm through with you, you're a real man. The kind that can prove it. You will be able to do things that you had thought impossible. And the beauty of it is you keep on going. Your deep full chest breathes in rich, pure air, stimulating your blood and making you just bubble over with vim and vitality. Your huge, square shoulders and your massive muscular arms have that craving for the exercise of a regular he man. You have the flash to your eye and the pep to your step that will make you admired and sought after in both the business and social world.

This is no idle prattle fellows. If you doubt me, make me prove it. Go ahead. I like it. I have already done this for thousands of others and my records are unchallenged. What I have done for them, I will do for you. Come then, for time flies and every day counts. Let this very day be the beginning of new life to you.

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How to Select an Oil Burner

By Harry F. Tapp

(*Continued from page* 801)

550 gallons and 1500 gallon tanks are used, depending upon the size of the house and delivery facilities. Naturally, if it is necessary to excavate in rock, the cost will be greater, in which case the storage tank should be as small as is practical for your particular needs.

Initial Cost of Oil-Burner

EVERYONE is interested in the question of costs with oil as compared with coal and gas. With figures it is possible to prove this question almost any way desired. Extravagant claims either way should be materially discounted. It is safe, however, to assume for the purpose of comparison *that a good oil burner properly installed and adjusted will heat your home at a cost that is comparable with anthracite coal.* As compared with the use of manufactured gas, at average prevailing rates, the cost of oil will be materially less.

The cost of oil-heating equipment varies with the type of burner installed and the storage tank size and location. The cost will average between $650 and $750. The cost of outside storage tank installation depends upon the conditions of the soil in which the tank has to be buried and local rules governing the tank installation. Oil-heating equipment should not be purchased on the basis of economy alone. It is necessary that the purchaser consider all of the advantages that are obtained by its use, and when these are taken into consideration any reasonable difference in cost is easily justified.

Most burners are sold today with a service guarantee period ranging anywhere from three months to one year. At the end of the service guarantee period, service calls are charged for at a rate depending upon the location of the burner in relation to the servicing station and to a certain extent upon the number of burners installed in the community. Most companies or dealers will provide a service contract at a flat yearly rate. The only additional cost to the owner is the price of any parts that must be replaced or repaired.

The conflicting claims of the numerous rival manufacturers and dealers make it difficult and confusing to anyone attempting to select oil-heating equipment. Claims are made, for example, that because of superior and revolutionary design features the "Peculiar" burner is so much more efficient than any other that it will use 25 to 50 per cent. less oil. Such statements can be discounted 100 per cent. The efficiencies of well-designed and skilfully manufactured oil burners will probably not vary more than 5 per cent. under equal operating conditions. The skill with which they are installed and adjusted will make far more difference in the efficiency than inherent features of the design.

The most important feature of design is to incorporate operating reliability and long life through the use of carefully selected material. This together with a sound and efficient manufacturing organization provides a mechanical unit that will give satisfaction.

When considering the purchase of a burner make sure that the dealer is financially responsible and mechanically competent to properly install and maintain the equipment. This can be done by interviewing a number of owners having the equipment you contemplate purchasing.

To sum up—first select only burners manufactured by nationally recognized organizations. Investigate several as to their mechanical construction, keeping in mind the possibility of having to replace worn parts in the future. Simplicity and reliability are closely related. With the knowledge that the dealer is reliable in every respect, you can be assured the results will be highly satisfactory.

(Next article will cover the installation of oil-heating equipment.)

In RADIO NEWS for January, 1930

Herbert Hoover, Jr., Commercial Engineer, Western Air Express, tells what radio has done, and what it will do, for the safety and development of commercial aviation.

Dr. Lee DeForest, inventor of the audion, describes the manifold non-radio applications of this marvelous electrical valve.

E. N. Pickerill, the flying radio operator, tells what the Radio Marine Corporation is doing to develop aviation radio.

Mr. B. Sleeper, President Sleeper Radio Laboratory, Former Chief Engineer Pilot Electric and Manufacturing Co., discusses remote control of radio receivers.

Norman Wunderlich, Chief Engineer, and W. F. Diehl, Assistant Chief Engineer of Radio-Victor Corporation show how laboratory control is maintained over radio parts manufactured under mass-production demands.

These are but a few of the outstanding leaders in radio who help to make January RADIO NEWS one of the best—and most important—issues we have ever produced.

Illuminated Table Decorations

(*Continued from page* 830)

that the lamps are scattered over the surface. About the sockets are then pasted red petals shaped like poinsettias to give the effect of the Christmas flower bursting from a white ball.

LIGHTED FIGURES—With a head large enough to conceal a small lamp, the figure may be of a size sufficient to alone decorate the center of the table.

It is more effective that the figures be small enough, however, so that the head is composed of a bulb lamp on which the face is painted. The socket rests on the top of a 6-inch supporting wire, to which the electric wires are bound with spool wire. Two lengths of light-weight wire bound with crepe paper and twisted, one about the socket and the other about the central standard, form the foundation for arms and legs. The figure is now ready to be dressed in an appropriate costume.

BALLOONS—Lighting balloons is quite simple. Fit a string of series Christmas tree lamps with clear bulbs. Inflate the balloon. Grasping the neck of the balloon between thumb and forefinger of left hand, with the right hand force the lamp—dampened with water—into the open end of the neck. The rest of the neck is worked over the bulb while base and socket remain outside.

(To be concluded)

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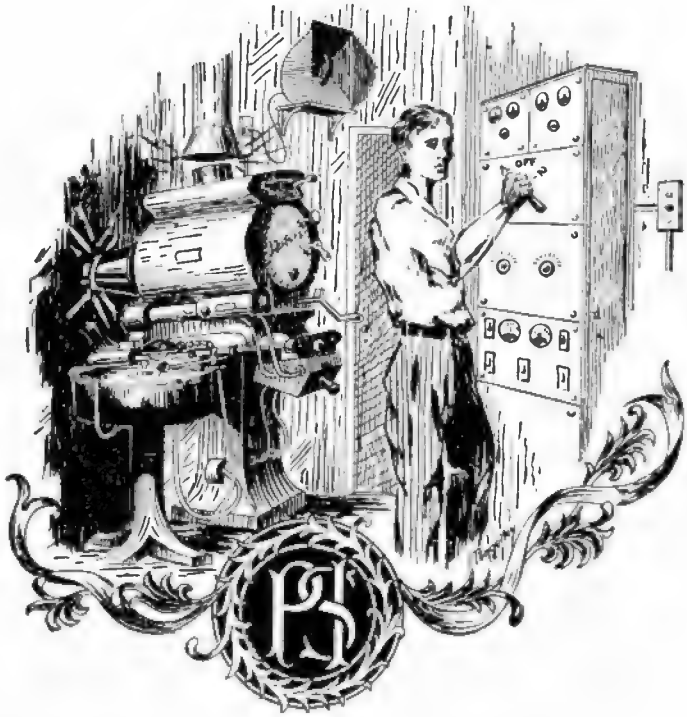

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The City of Tomorrow

By H. Winfield Secor

(*Continued from page* 787)

trees. Surely M. Le Corbusier is, some of us might think, far ahead of his time; but aside from a few practical visionaries in this country, such as Mr. Harvey Wiley Corbett, the writer has certainly seen but very little in the proposed designs for future cities which can begin to approach the remarkable and logical schemes illustrated and described at great length by M. Le Corbusier. To read his descriptions and study his illustrations is like taking a post-graduate course in super-architecture.

Le Corbusier is an architectural surgeon, so we might term him, and to rectify the difficulties in which our modern cities find themselves, due to intense traffic congestion and many other undesirable features, it will be necessary to perform in many cases undoubtedly some real drastic surgery, as pointed out by this French authority. In other words, if traffic is extremely severe and congested in a certain section of a city, one of the remedies is to blaze a new trail across the congested area at that section and open up a new wide boulevard, even though many blocks of buildings have to be removed, for only in this way can we make some kind of a fresh start towards simplifying the main line of traffic.

If some genius does not soon find a radical solution for handling automobile traffic in the large cities like New York, it will shortly come to pass that the number of taxis will be curtailed by law, and also the workers will have to stop using motorcars and go back to the subways. Did you ever stop to think of the vast amount of space and also the fuel wasted each day to carry one person to work by auto. The average car occupies 160 square feet on the street. One man needs or gets about 2 square feet in a subway car. If he drives an auto he is taking up as much valuable city space as 80 men should.

Book Review

PREHISTORIC MAN, by Keith Henderson. Stiff cloth covers. 6 x 8 inches. 272 pages, 102 illustrations. Published by E. P. Dutton & Co., New York City. Price, $3.00.

In a vivid and picturesque style, the author tells the story of man's ascent through the prehistoric ages. Nothing more fascinating or interesting has been written about the cave dwellers, the beginners of tribal customs, dress, and beliefs. The text is further enriched by a number of unusual illustrations. As one turns the pages he takes a delightful educational journey into man's prehistoric past.

JOINT WIPING AND LEAD WORK, by William Hutton. Flexible fabrikoid covers; size 5¼ x 7½ inches, 90 pages, 116 illustrations. Published by Scientific Book Corp., New York City. Price, $1.00.

This valuable manual has been prepared so that illustrations of the actual work accompanying the text and take the place of personal instructions in joint wiping of lead, copper, and brass pipe. When preparing the material, the author kept in mind the needs of the inexperienced plumber, and he has consequently explained each step by means of photographs, so that the mechanic will have no difficulty in understanding it. The book also contains numerous hints on lead work, the care of solder, preparation of parts, the handling of lead pipes, and the use of the right tools.

STAIR BUILDER'S GUIDE, by Morris Williams. Flexible fabrikoid covers, 5¾ x 8½ inches; 259 pages, 358 illustrations. Published by the Scientific Book Corp., New York City. Price, $3.00.

Stair building differs from other branches of carpentry; it is a science whose fundamentals lie in problems of plane and solid geometry. This book explains the simplest method of the art in its present stage. The construction of straight flights, platform, cylindrical and elliptical stairs is dealt with, and the theory and practice are explained so that the average building mechanic can readily understand them. Examples of work from the simplest to the complex forms are also included. Carpenters and those engaged in building will find in this volume a much looked for handbook of exceptional merit.

RADIO TROUBLE-SHOOTING, by Emno R. Haan, E.E. Soft, flexible covers, 6 x 9 inches; 328 pages, profusely illustrated. Published by the Goodheart-Wilcox Co., Inc., Chicago, Illinois. Price, $3.00.

The author in preparing this valuable book on radio, has treated the subject with a view to assisting the repairman, as well as showing the layman how he can do his own repairing at home. The book deals only with radio troubles and their remedies, and shows anyone exactly what is wrong with the receiver and how the trouble may be corrected. The subject of trouble-shooting is treated in a practical manner with definite instructions and a host of illustrations, showing how to test the various components, how to trace trouble and remedy it, and most important of all, how to take care of the receiver properly, in order to eliminate any further trouble. Free from any theory on the subject, the contents are based on actual practice. Trouble is bound to arise sooner or later even in the best of instruments, and the author has foreseen this in Radio Trouble-Shooting.

AEROBATICS, by H. Barber, F.R., Ae. S., M.I.A.E. Stiff cloth covers, 8 x 10¾ inches; 78 pages, illustrated. Published by Robert M. McBride & Co., New York City.

In Aerobatics, Captain Barber has presented a complex subject in such a way as to make it thoroughly readable and understandable. The book should prove valuable to students and instructors of flying particularly because of its excellent illustrations, which show clearly in consecutive detail each of the different evolutions in aerial aerobatics. Part one, which is called Elementary Flying, is a lucid explanation of the essential elements of flight instruction from the moment the prospective student enters the plane until he becomes a full-fledged pilot. The mechanical control of the machine, straight flying, stalling, gliding and landing, are fully described in language for the lay reader. Part two explains the more advanced aerobatics, such as looping, spinning, rolling, the falling leaf, the cartwheel, and the like. The book also contains a glossary of technical terms and a number of advisory hints which will greatly aid in turning a raw pupil into an expert pilot within a short time and with the greatest margin of safety.

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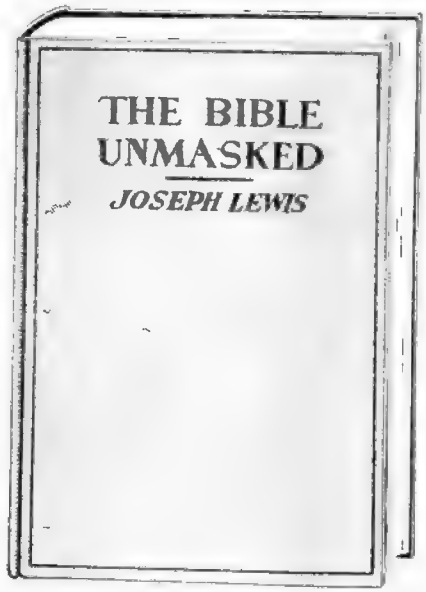

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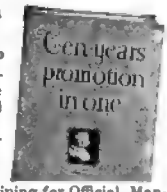

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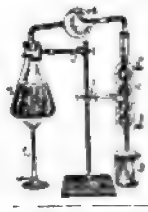

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Making Scissorless Silhouettes

By H. H. Dunn

(*Continued from page* 807)

motion-pictures in the studios, and still pictures from one of them—a screen version of "Mother Goose"—are shown herewith. But the maker of silhouettes in the home needs no such expensive preparations. A screen of white cloth or tracing paper, sufficiently large to cover completely a door or full-length window, is the only requisite, aside from the camera. Lacking other material, an ordinary sheet will serve, though the best screen is eight by ten feet in size, so as to cover fully all space through which light may enter.

The door or window selected should face to the north or south, so that the sunlight comes from the side, rather than directly against the screen, as it would if the latter faced east or west. Care also must be taken that the screen is drawn tight, and that there is no wind heavy enough to distend it, or make it flap about. Holes larger than one-thirty-second of an inch will admit too much light and thus spoil the picture. If possible, it is best to have no holes of any size whatever in the screen, though the latter cannot be coated with shellac or other material to "fill" such openings.

In making silhouettes by sunlight, the work should be done before ten o'clock in the morning, and after three o'clock in the afternoon, so that the light comes from one side, rather than from directly overhead. North or south of the Temperate Zone, these time limits vary, but in general, the more horizontal the sun's rays, the better the result. The secret of making silhouettes, either the "stills" now under discussion, or motion pictures, to be described later, is that all light must come from the *back* of the subject, that is, from *behind* the screen, whether it be the sunlight through the open door or window, or the controlled electric light of the studio.

To accomplish this result, all light save that which comes in *through the screen*, must be excluded from the room in which the picture is being made. When this has been done furniture, plants, or any other objects may be placed in the front of the screen with the person or persons to be photographed, and no object in front of the screen will cast a shadow on the white and light-filled sheet. One rigid rule is that all persons, animals, or objects to be silhouetted *must be at the same distance from the screen*. This distance should be as close to the sheet as the largest object can be placed, though it is best that nothing touch the screen at any point.

With his "picture" so arranged, the amateur photographer sets up his camera, squarely in front of the screen, and at such distance as will make the size of negative desired. Usually it is best to make the outer edges of the screen the limits of the picture, though the writer has seen some silhouettes in which a dark frame of wood, or card-board, was placed all around the screen, giving the resulting picture the effect of a large and rich painting in black and white.

If the photographer is working with a focusing camera, he uses the ground glass just as he would in making any other picture. If he has a hand camera—placed of course on a tripod or other solid support—he must measure the distance carefully, after locating and "sizing" the image in the view-finder. If the distance required is, let us say, ten feet, then he must have the lens exactly ten feet from the persons or objects in front of the screen, not an inch more or less. He also must guard against measuring to the screen, instead of to the outer surfaces, sides or edges of the persons or objects to be pictured. Size of the aperture and time of exposure vary with the character of the lens used, and are matters which can be determined accurately only by experience. The writer has seen some very fine silhouettes made with a hand camera costing $2, in which the aperture was the smallest available and the time the ordinary "instantaneous" release of the shutter, probably about one-twenty-fifth of a second. As the quality of the lens advances, the stop may be made smaller and the time increased to the point where the fairy tracery of a fine fern leaf becomes literally etched against the white background of the screen.

In such pictures as those described, all motion must be stopped; that is to say, the one or several persons in the picture must remain perfectly still. No matter how

Paramount Pictures Photo

A slightly different silhouette, showing the effect of adding extra scenic properties to the picture and giving more life to the subject. Real surprise shows in the face of beautiful Doris Hill when she sees the "four-and-twenty blackbirds baked in a pie."

good the lens, or how short the time of exposure, the slightest movement will result in a "blurred" picture. Thus, plants placed against the screen must be given time to become absolutely still; animals must be taught to maintain their positions, and, usually, children rehearsed in their parts in the picture.

Until Dyar discovered this method of using the lens, a silhouette had been considered as capable of presenting only a "flat" picture, of two dimensions, length and breadth. By the skillful use of a hand-mirror, however, the third dimension—thickness—may be expressed. In the original this was done very successfully in the picture of the "four and twenty blackbirds baked in a pie," presented herewith. The original shows virtually a three-quarter portrait of the young woman, with much of the front of the face and neck presented as in a regular portrait, yet still in the black and white of the real silhouette

When using the mirror for this purpose, it should be held at one side of the screen, so that it catches and "throws" a little—and only very little—of the light passing through the screen from the outside. Such a light beam must be carefully controlled, so that it falls only where wanted; that it is not too heavy; and that the mirror casts no shadow anywhere on the screen.

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Automatic Railway Safety Gates

(1199) George Nothaas, Cleveland, Ohio, writes:—

I have an invention which relates to Automatic Railway Safety Gates that would prevent all accidents on highways and railroad crossings. It works by electric current so that on approach of the train, the gate would be automatically closed and stop the traffic, and when the train passes, the gates would be open again. Kindly give me your opinion.

A.—We cannot hazard an opinion upon a railway crossing gate, the construction of which is not disclosed in your letter.

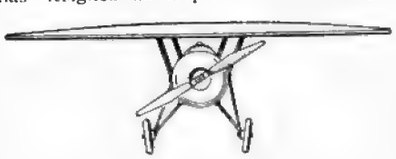
Will your railway crossing gate effectively prevent traffic in both directions and yet permit any traffic caught half-way between the gates and on the railroad right-of-way, to pass safely off the tracks?

Is your safety gate so arranged that it cannot possibly injure the top of an automobile, a wagon, or come down on the head of a pedestrian?

Is this safety gate so arranged, that should traffic accidentally stop midway between the railway crossing, the engineer of the locomotive will be given a signal, so as to notify him of danger ahead? If the gate comes up from the bottom of the road, will it permit an automobile with its front wheels across the gate, to safely pass to the other side of the railway right-of-way? Will your safety gate operate in all kinds of weather conditions—rain, snow, sleet and ice? Can your safety gate be erected so that it will not necessitate an additional space for railway right-of-way? Is your safety gate relatively inexpensive to install and is it practically fool-proof and will it remain in order for almost indefinite lengths of time? If you can answer all of these questions affirmatively, then perhaps it might be a good idea to apply for a patent on the same. We must have further details before our answer can be more specific.

Telescopic Airplane Wings

(1200) M. S. Chapman, Johnstown, Pa., has designed an airplane with telescopic wings for increasing the speed of flight after the plane has left the ground and in turn permitting the plane to decrease its landing speed. He asks our opinion.



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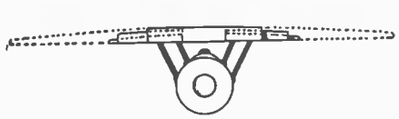
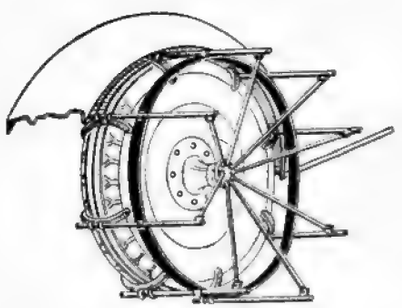


FRONT VIEW CLOSED

A.—Many patents have been taken out on various types of airplane wings which are telescopic, or change contour so as to increase the speed when flying and decrease the necessary landing speed. We do not believe that your suggestion is in any degree superior to those that have already been patented, nor do we hold that there is an immediate future market possibility for a product of this kind. Your chances for selling such an invention are also slight. We consequently advise no further action.

Auto Wheel Attachment

(1201) W. H. Vande Hei, Manitowoc, Wis., asks what we think of a wheel attachment for automobiles to permit of traveling through drifted roads. The nature of this construction is further seen in the diagram.



A.—Many devices have found their way upon the American market which tend to prevent an automobile wheel from slipping in traveling through drifted roads. Many of these devices give considerable traction. Most of them fit on the automobile wheel by simply snapping them around the rim. They take 1/10 to 1/50 of the time to attach one would need for your device and we consider that they are even stronger than your system, which, because of the nature of its construction, would not give a reasonable bearing and traction service. Any lugs extending from the wheel and as insufficiently braced as those lugs are in the device you have designed, would get out of order very quickly.

Further, the mud guards so cover the tires that a decided change in shape is required to permit the movement of the arms.

In view of the fact that we consider your system mechanically weak, and that we consider it very difficult to attach, we certainly would not suggest that you apply for a patent on this idea.

At the right is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ.

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What I Found on Board the R-101

By Augustus Post

(*Continued from page* 781)

The galley (kitchen) fittings are even lighter; cookers, stoves, pipes and a forty gallon hot water tank are all of aluminum.

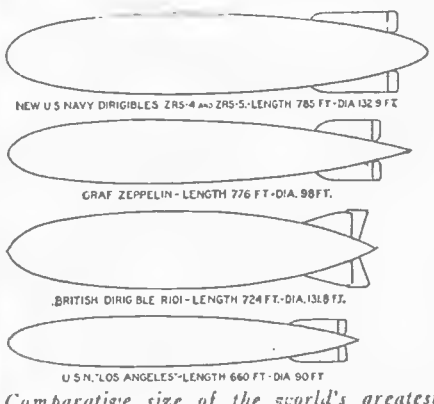
Passengers come on board by way of the mooring-masthead at a height of 200 feet, to which they ascend by a lift or elevator inside the mast to a platform or gallery at the top; they then enter the airship by means of a gangway let down from the bow of the vessel in the same way that you board a ship. You then pass down by an enclosed corridor lighted by electricity to the passenger coach. This structure is slung inside of the hull and is surrounded entirely by a double wall, through which air is circulated to obviate the danger of any inflammable gas or vapor penetrating to the living quarters. Windows in the side of the airship provide light and an opportunity to look out at the view below; promenade decks, spacious enough for a tea or a dance, are also provided. Beyond the passenger coach the corridor narrows and is used by the crew and for storage purposes, fuel tanks and cargo. Ballast tanks are placed on each side of the ship so that by transferring the contents from one side to the other the ship can be trimmed.

The five *power eggs* (named so from their shape) look small against the huge bulk of the ship, and the only other projection is the *control car* as the passenger cabin is entirely within the hull.

One of the most notable features is the perfect smoothness of the outer skin, which is obtained by a very clever stretching device, light longitudinal girders that can be screwed out to give the required tension.

The openings around the nose and at intervals in the outer covering insure a current of fresh air throughout, and ventilate the hull thoroughly.

In the stern are the fins and rudders that serve the same purpose as the same elements on a fuselage, insuring axial direction in flight. The outside covering is linen balloon cloth treated with airplane dope and red oxide of lead to cut down the effect of the actinic rays of the sun. The silver color comes from a coating of aluminum paint to reflect the light and heat. As these ships were built for the Egyptian and Indian Service, the question of temperature in hot countries is a serious one, and not only affects the lifting power of the gas, but makes it difficult to make landings without loss of gas by valving.


NEW U S NAVY DIRIGIBLES ZRS-4 AND ZRS-5-LENGTH 785 FT-DIA 132.9 FT
GRAF ZEPPELIN - LENGTH 776 FT-DIA. 98FT.
BRITISH DIRIGIBLE R101 - LENGTH 724 FT.-DIA. 131.8 FT.
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Both these dirigibles, the R-101 and R-100, use hydrogen because it is difficult to secure helium gas, which is about six-

One of the passenger staterooms on the R-101.

teen times more expensive, but is non-inflammable and practically eliminates the fire risk. The gas is contained in goldbeaters skin cells enclosed in a special form of netting within the metal framework. Fifty parachutes were carried. Each rigger carries a knife in the ordinary course of his duties. These knives, should an emergency arise, are to be used for the purpose of slitting the fabric to permit passengers or crew to jump.

Commander L. V. Richmond is to be heartily congratulated upon bringing to a successful launching the world's largest airship to be flown up to this writing; one which cost over two and a half million dollars to build. It was flown on October 14th, 1929, after being brought out of her hangar two days before and moored to the mast. A notable company was on board for the first flight, including Sir John Higgins, Air Marshal; Major G. H. Scott in command and Flight Lieutenant Irwin. I had the pleasure of meeting Major Scott when he piloted the first British dirigible to visit our shores, the R-34, in 1919, returning safely to Pulham in 75 hours, after circling Times Square in a blaze of searchlights which flashed on her silvery sides as she departed at midnight.

Novel Mechanical Features

IN the construction of the R-101, every precaution has been taken to guard against the possibility of fire, and for the first time gasoline engines have been superseded by engines burning heavy fuel oil with a flash point of 210 degrees Fahrenheit. To carry the 29 tons of fuel, 38 main tanks are attached to the framework of the ship (inside the envelope) 28 of which hold 224 gallons and 10 112 gallons apiece. In addition there are 11 compensating tanks which are filled when the full load of passengers is not being carried. Several of the main tanks have emergency gear for the quick release of fuel, if required. The bottom of the tank may be cut away by a mechanical device, in a manner somewhat similar to the method employed in opening some types of cigarette tins. For heating and ventilating the passenger cabins, air is drawn in by an electric fan and passing through

(*Continued on page* 849)

What Famous Men Predict for Science in 1930

Walter P. Chrysler

(*Continued from page 779*)

bration, by the use of stiffer chassis frames and above all by the unit design of body and chassis, which permits the two units to be joined as one unified assembly with no points of weakness. The automobile of the future will be thought of as one balanced assembly, rather than as a group of assemblies joined together. The same qualities that produce longer life also produce quietness. In addition the use of live rubber where it logically belongs, for the purpose of insulating shocks and vibration, will increase and greatly contribute toward life and silence. Adequate provision for chassis lubrication is also a factor that is securing greater recognition than ever before. From the performance standpoint, everything that the motorist desires will be provided. Better acceleration, better braking, smoother, easier operation with facilities for comfort and convenience will be featured in the car for 1930.

Harvey Wiley Corbett

(*Continued from page 779*)

be built not with such intensive use of hand labor as at present but with a fastening together of parts previously manufactured in the factory, assembling so to speak the various elements of the building in much the same manner as automobiles are assembled. The heavy masonry walls, which are now hung on the steel frame, which of necessity carries the load, will be replaced with hollow construction—using much more glass and metal and less handmade masonry.

I regard these points as the outstanding features of progress in the next few years.

William Dubilier

(*Continued from page 779*)

tubes will be the average employed in sets.

I do not believe remote control will appeal to the public, as it is an unnecessary and costly complication. The trend is toward simplicity.

Improvements will probably be made in the electric phonograph and radio set combination. Instead of using only the audio amplifying stages in connection with phonograph pick-ups, as at present, while the radio frequency stages are idle, the phonograph pick-ups will be simplified and so arranged as to affect the first radio amplifying stage and thus utilize all the amplifying tubes in a set. This method will enable improved music reproduction, as simple phonograph pick-ups generating in the order of .01 volt instead of one volt, as is used at present, will result in more effective reproduction by the loud speaker.

Band filters will probably be used in the tuning stages, which will improve reproduction, especially of distant stations, for at present when a station is tuned in, high notes are often eliminated on account of the sharp tuning. By keeping the same sharp tuning but widening the band of tuning, the high notes will come through with the same intensity as the low notes, and reproductions will become much more natural.

Enough constructive inventions have been suggested to predict that fading effects will be reduced.

One of the most important factors in the radio industry will probably be straightened out during 1930, and that is the unsatisfactory patent situation. Either a holding company will be formed by the manufacturers' association to provide for the purchase of all patents into one group, and licensing all reliable manufacturers; or

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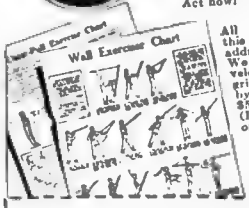

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else most of the large companies holding valuable patents will amalgamate their patents, protecting the licensees from future litigation among themselves and by outsiders and tending to stabilize the industry. Unless such a course is followed, the radio companies are not assured that some patent may not prevent their doing business and will therefore work entirely on a year-to-year basis.

Augustus Post

(*Continued from page 779*)

greater respect but a much wider use of the lighter-than-air craft.

The already projected lines across the Atlantic by the Zeppelin Company and across the Pacific by the Goodyear Company, and the line from England to India by the English government, will be actually in operation before we realize it.

Races between dirigibles, both large and small, may furnish a new sky thrill, and serve to bring development much faster.

The principle of compression ignition or the Diesel engine, will be used more and more as the technical and mechanical problems in its adoption to aircraft are solved, such as perfect fuel control, reduction of weight and the construction of the two-cycle Diesel. There is no doubt that, as the aircraft industry has had much help from the automobile industry in its early stages, the rapid advance of aircraft engineering and new structural and motive power development will be of inestimable value to motor-car builders, and a two-cycle Diesel engine in mass production should quickly give a superior power plant.

Platforms on city centers, "floating islands," in the ocean, like the Armstrong seadrome raft, new and better instruments for navigation and control in fog, partial automatic pilots and altimeters to tell not only how far you are above the surface of the ground; but the "Sonic" type may also be used to indicate if there is a mountain ahead, and give ample warning if it is obscured by fog or darkness. Fog-penetrating lights or "infra" signals from beacons, radio direction beams for the pilot to follow, rapid extension of meteorological information to include the ocean as well as all parts of the earth. No spot on the earth's surface will be unseen by the eyes of man, the Pacific will be crossed without stop, the world circumnavigated by refueled flight, an altitude of 50,000 feet will be reached by the assistance of rocket propulsion and we shall soon see further development of the reaction motor, with more complete control and use of liquid gases for propulsion.

Prof. R. H. Goddard

(*Continued from page 779*)

rocket plane travel, have already been made under my direction in Auburn, Massachusetts, but these rockets are at present being developed for meteorological purposes only. America is not yet fully alive to the possibilities of the rocket and the uses to which it can be put.

"Casey" Jones

(*Continued from page 779*)

mean lower rates, it is believed that tonnage of mail will increase constantly, which will lead to the development of planes of much larger carrying capacity and greater speed. While the performance of mail lines has been extraordinary, they have been held up somewhat by fog. The landing experiments conducted by Lt. Doolittle have worked out very satisfactorily and possibly in 1930 developments will be continued to

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such an extent as to make flying in fog possible, and if this is accomplished, airplanes will be able to fly under any weather conditions.

Many efficient and well-operated passenger lines have been established in 1929, and 1930 will show increased patronage of these lines on the part of the public as a necessary adjunct in conducting modern business.

Several large passenger transports with two, three and four motors have been developed in 1929, and the introduction of these on the passenger lines will increase the efficiency of the lines and by doing this will encourage the increased use of them.

By 1930 many well conducted flying schools, under the approval required by the Department of Commerce, will be in operation, with new equipment, well organized fields and competent personnel. This is bound to increase the interest, particularly among the younger generation, in learning to fly. The establishment of numerous airports and well-equipped service stations throughout the country generally, is bound to encourage private flying.

Generally speaking, the outlook for 1930 in aviation is excellent, and with the developments mentioned above we are looking forward to a most prosperous year.

Turbo-Electric Drive for Passenger Liners of Major Importance, says Frank V. Smith

Federal and Marine Dept., General Electric Co.

TURBINE electric drive for ships is an American development independently planned. It has in a few years built and laid the foundation stones of what has become the most distinctly progressive

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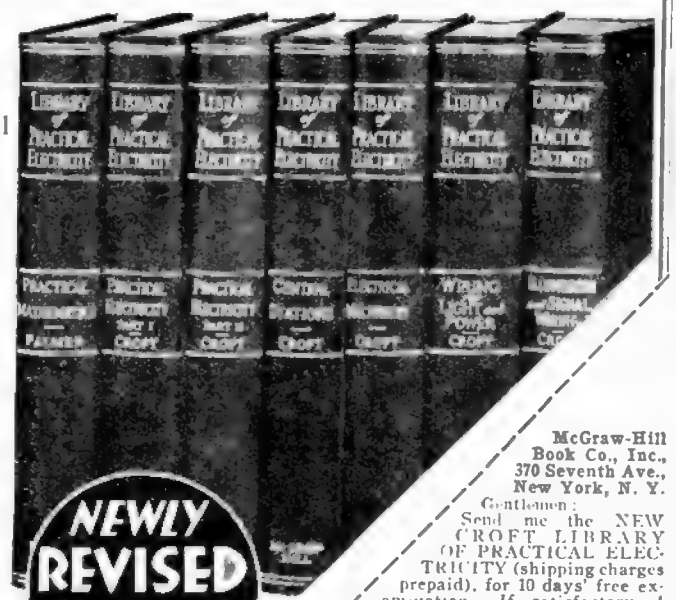

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The handwriting on the wall points to the all-electric passenger liner as being the liner of the future, because the people once having tasted of the fruits of the newer engineering will not turn backward.

Some Scientific Radio Problems Which Will Be Studied in 1930

By Dr. L. W. Austin

Laboratory for Special Radio Transmission Research, Bureau of Standards

THE most puzzling of the present problems in radio-telegraphy is the determination of the cause of the long delayed radio echoes discovered by Stormer and Hals in Norway, which are sometimes received on very short

Photo by Bachrach

waves from one to thirty seconds after the main signal has arrived. The question seems to be whether these echoes travel with the velocity of light and are reflected back from clouds of ions in space far out beyond the orbit of the moon, or whether they are simply delayed in some way not yet clear in their passage through the earth's upper atmosphere on their way to the receiving station.

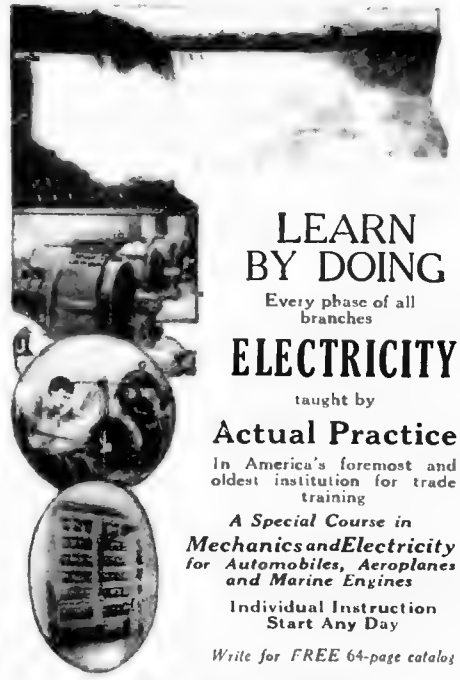
Among the other questions which demand further study are: The general electrical conditions in the upper atmosphere and the characteristics of the radio waves which are reflected back to earth; whether the variable deviations in direction finding are always due to abnormal polarization in the down-coming wave, or sometimes to a real change in the direction from which the wave reaches the direction finder; the connection of solar activity and magnetic storms with radio reception; whether true static is entirely due to lightning discharges somewhere in the world, or to atmospheric discharges of another nature.

Progress in Aviation

By "Eddie" Rickenbacker

America's Premier Ace

PROGRESS in aviation during 1930 in my opinion will be in a steady advance along all lines of aeronautics both lighter-than-air and heavier-than-air,



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ably the forerunners of much larger ships. In the same way lighter-than-air aviation has seen the girdling of the globe by a dirigible and the launching of a still larger ship in England while two dirigibles nearly twice the size of the Graf Zeppelin are under construction at Akron, Ohio. These airplanes and dirigibles undoubtedly will be dwarfed by the ships yet to come but this advance will not be made in a year.

I look for the extension of air transportation in 1930 comparable to its tremendous growth in the past two years. I look for construction of many more airports, which are essential to stable growth of the industry. I look for increasing care in training of personnel which will eliminate casualties caused by pilots' mistakes. This is the growth that aviation needs and will have in 1930.

But I do not overlook the possibility of a revolutionary step forward by some inspired engineer or inventor. With aviation still in its youth anything is possible.

Astronomy in 1930

By Dr. Donald H. Menzel, Ph.D.

Of the Lick Observatory, Mt. Hamilton, Calif.

TO attempt to recount all of the advances of astronomy in so few words is an impossibility. To confine my remarks to but several of the many achievements is hardly fair to the investigators whose researches are of equal or possibly greater merit. I shall take a bird's-eye view of the battle-ground of science, so that the individual landmarks fuse together. The enemy is ignorance; the skirmish line is the frontier of knowledge; the unknown lies just ahead.

Each passing year has seen greater cooperation between astronomer and physicist—and now the respective sectors (if there be two) are so united that no division can be distinguished. The scientists are fighting each other's battles. That heavy barrage is being set up by the relativists, who are more firmly entrenched than ever in their conviction that Einstein is right. The fight has not been easy and there is no sign of cessation of fire.

There is another scene of tremendous bustle. The atomic theorists are waging

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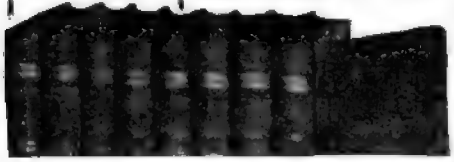

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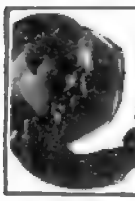

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an attack, and new ground is fast being won in fields both physical and astronomical. It is significant that the greatest activity always occurs in the neighborhood of the physicists. Judging from the

Brown-Byers Studio, Denver

Dr. Donald H. Menzel

progress of the past year, it seems safe to predict that the major activity, in 1930, will be confined to those branches of astrophysics most closely related to atoms, and that the close of the year will witness a marked advance in our knowledge of the spectra of sun, stars, and nebulae.

What We May Expect in Radio as Visioned by John V. L. Hogan

If present tendencies are a safe guide, we may expect radio broadcast receivers of 1930 to be characterized by the more efficient use of fewer tubes, by further simplifications of operating adjustments and by even better fidelity of

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John V. L. Hogan

LIFE-TIME DX AERIAL

Guaranteed Double Volume and Sharper Tuning

Description of Lifetime DX Aerial

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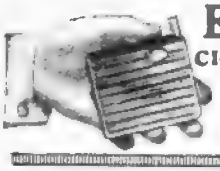

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reproduction than is shown by today's average. Automatic and distant-controlled tuning and volume setting arrangements seem likely to be prominent.

The preparatory work of 1929 should result in moderately extensive exchange of international programmes during 1930. There have already been several notable examples of such relay broadcasting, and the coming year is likely to bring forth many more of them.

In radio communication, it is certain that both the radio telephone and radio telegraph will batter down old barriers and provide a communication service between nations not now connected by radio. Even the old dream of a national inter-city service by radio seems about to come true, although perhaps in a somewhat limited form.

As to electrical entertainment, aside from broadcasting, we may hope that intelligent application of radio principles will further improve the talking motion picture as it has the phonograph for home use. Perhaps we may even have television in such simple and practical form that we can enjoy it in our own living rooms, but it has been "just around the corner" for so long, that the *doubting Thomas* clan must be admitted to have some grounds for its skepticism.

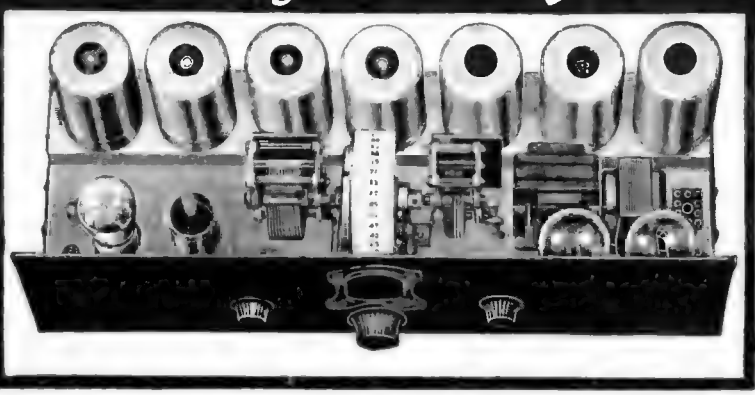
A Vision of 1930 by President of Radio-Victor Corp. of America

NEW high standards of utility, quality and appearance have been set for the 1929-30 radio season by an experienced and discriminating public. In previous seasons, public preferences have been clearly defined in one or more particular features of receiving set technique. Thus, in the early days a radio set was

J. L. Ray, President, Radio-Victor Corporation of America.

judged by how many distant stations it could bring in. Attention was next directed to power supply, passing through a period of evolution from dry battery, storage battery, and "eliminator" operation to perfected socket power operation. As the permanency of radio became assured and increasing numbers of broadcasting stations crowded the air, good selectivity became the prime requisite. As the first novelty of radio wore off and the public became more exacting, the old horn type of reproducer gave way to the cone speaker

The NEW H-F-L Mastertone Laboratory Made Receiver



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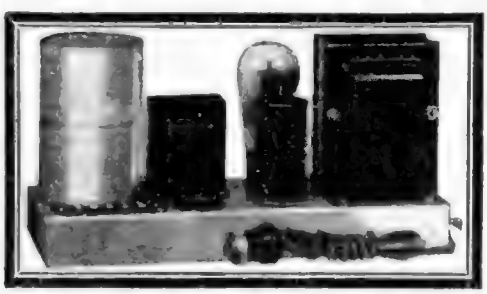

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and the electro-dynamic speaker; the multiple and involved controls of the early radio set resolved into the simplified tuning and volume controls of today. From the ungainly and disorderly looking radio assemblies of yesterday the radio receiver has emerged as a thing of beauty, self-contained and enclosed in cabinets which grace the most pretentious as well as the more modest homes. Now, all the requirements of sensitivity, selectivity, good tone quality, simplicity of control and appearance which were the exception in previous years, are embodied in the present-day radio receiver.

Another outstanding feature of the current radio season is the unusually good values which obtain. At no time in radio's short but spectacular history has it been possible to get so much for the radio dollar. No one, regardless of circumstances, need now be without the manifold pleasures which the ownership of a radio brings. Nor need anyone cling to the old and obsolete receiver which has outlived its highest efficiency through radio's experimental and formative days, for in this fast moving art the 1929-30 radio differs as much from the radio of four, three, and even two years ago as the 1930 automobile from the early "horseless carriage." Everyone can now own a radio, which may range in an almost limitless variety of design from a modest but highly efficient table model to the most advanced product of radio and phonograph engineering and cabinet craftsmanship.

Probable Advances in Radio

By Dr. Alfred N. Goldsmith

Vice-President and General Engineer, Radio Corporation of America

RADIO broadcast transmission, far from having reached a final condition, is still rapidly evolving. During 1930, 50-kw transmitters will become increasingly common, and transmitters of still higher powers, perhaps running into several hundreds of kilowatts, will be used, at least experimentally. As a result of this power increase, service to rural and urban listeners will be still further improved.

International broadcasting is also developing rapidly and 1930 will unquestionably see Europe and America more frequently linked by programs heard in both continents. Communication between the ground and aircraft, both for transmission of information and for directional guiding of planes, will become a standard procedure in the near future. The application of radio to automobiles will probably also expand rapidly.

Although not strictly a radio device, electrical musical instruments are beginning to assume an important position in public interest and may be expected to become a definite factor in the musical life of the United States during 1930.

Radio receivers will become increasingly simple, even more precise in their reproduction of the original performance, and of increasing reliability and excellence in appearance. Radio television has remained in the experimental stage during 1929, and is unlikely to assume an important position in the entertainment of the public through the air in 1930. Its experimental development will, however, steadily progress.

Courtesy Notice

In the article "Railway Cars Take Wings," in our November issue, we should have mentioned that this system is known as the *George Bennie Railplane System of Transport*, the inventor being Mr. George Bennie of Glasgow, Scotland. We are glad to give this credit to the inventor.

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What I Found on Board the R-101

(*Continued from page* 840)

an engine radiator, it is warmed in cold weather and sent into the cabins through air gratings. In warm weather the radiator is lowered outside of the ship and cool air can be supplied to the living compartments.

The ship has the usual control car outside the main hull, and in addition a chart room above it inside the ship. This is virtually the "brain" of the ship with intricate apparatus for telling the condition of all parts of the vessel and communicating with the various stations; instruments are here to indicate the various strains to which essential parts of the structure are subjected in flight, and when moored to the mast. The strain on the mooring eye is shown by an electric indicator which tells whether the bow is light or heavy and by the strain on the bearing tube of the nose mooring the instrument shows whether the ship is bearing down or pulling up on the nose cap.

It was my good fortune to find the British Air Vice Marshal, Sir. W. Sefton Brancker, Director of Civil Aviation, in his office at the air ministry in London not long ago. He had just returned from a trip in the giant Dornier DO-X and he said: "I am very much impressed with the possibilities for ocean travel which this marvelous flying ship has proved to be feasible"; we naturally turned to a discussion of the relative merits of the large airplanes and the two big airships, the R-101 and the R-100, which I had just visited. He said "Just how they will be employed later it is impossible to say, but it is obvious that much experimental flying will be necessary before they can be applied to a regular service at the disposal of the public."

By special arrangement through the courtesy of Mr. Robert T. Pollock, representative of Lieutenant Commander Charles Dennis Burney, builder of the R-100, sister ship to the R-101, I was shown on board the twin of the world's largest airship, 5,000,000 cubic feet gas capacity.

R-101 Has Frame of Stainless Steel

IT is quite impossible to realize the titanic proportions of these tremendous structures, which are practically of the same size and gas capacity. The main points in which these two ships differ are in the frames. The R-101 is built on a framework of stainless steel tubing, one and a half inches in diameter with forged duraluminum end fittings with pin joints out of which the triangular girders are formed, which latter are used to build the keel and the longitudinal beams which run the full length of the ship from stem to stern, and also the immense circular girder work or rings that give form to the hull.

The frame of the R-100 is constructed of four-inch tubes of duraluminum helically wound and riveted, which are used to form the triangular girder work. Of special interest is the fact that any one of these triangular sections may be taken out and replaced in the girderwork in about four hours' time, if for any reason it should become necessary.

The R-101 is equipped with five Beardmore heavy oil burning *compression ignition* or Diesel type engines, 8 cylinders in line of 585-650 h.p. each, four of which are placed in power cars on each side at the 4th and 9th frames, while one is in the center car at the rear at the 11th frame. The port forward motor at present is only used for speed in the reverse

(*Continued on page* 850)

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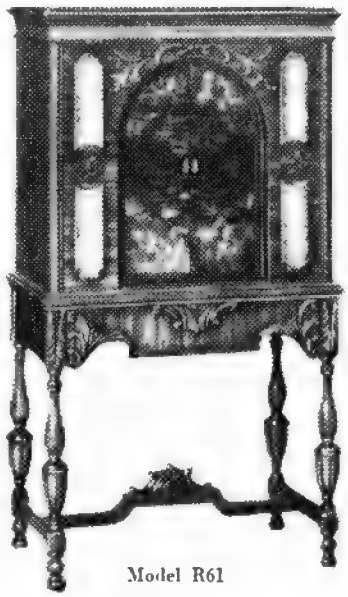

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direction. It was originally intended to use a form of reversible metal propeller so that the motor could be used for forward speed as well, but this has not been perfected, and wooden propellers are used. The use of fuel oil, besides minimizing the fire risk, reduces the power cost to about one-fifth ($25 a ton against $125), although the added weight of the engines will make it possible to carry but fifty-two passengers instead of one hundred, as originally intended. A small four cylinder gasoline engine is used for starting each motor and they also operate air compressors and generators for electric light, cooking and radio.

The R-100 has six Rolls-Royce *Condor* engines of 665 h.p., placed two in each car at each side and two in the central rear car. At present they will burn gasoline; but a new method of engine distribution and a fuel gas has been developed, which if applied at a later date to the R-100 will allow her performance approximately to be doubled. The comfort of the passengers has been lavishly provided for and the fittings of the passenger cabins, which are entirely within the hull, are equal to the furnishings on the latest ocean liners. In the R-101 a lounge, seating 100, extends right across the ship with verandas on each side from which one can look out through windows in the outer skin provided with safety glass.

There is also a dining room lighted with large panels which can seat 50 persons and containing a radio loud speaker. Underneath is an elaborate electric kitchen with dumbwaiter to the dining room. Everything is very light and carefully designed in every detail. On the trial flight of the R-101 the guests were served with a hot luncheon consisting of soup, roast mutton and vegetables, fruit salad, cheese and biscuits and coffee. The crew was dressed all alike in brown dungarees and white sweaters with white canvas shoes. The passenger cabins have spring beds, some with two and others with four berths, as on shipboard. The R-101 has, beside a lounge and dining saloon, a special all-metal smoking room, accommodating 30 people, enclosed with metal walls, fireproofed, and fed by forced air circulation isolated from the general ventilation of the ship. Electric cigar lighters are provided and the room is practically soundproof. This is the first time that it has been possible to allow smoking on an airship. I remember Dr. Gilfillan, who came over in the *Graf Zeppelin*, complained bitterly to me that he could not smoke, and others said that it was the one luxury that they missed most. The smoking room and the lounge have specially comfortable settees and chairs. The general ventilation is by means of ports arranged like *grills* and any excess of pressure inside the envelope can be relieved at once. A current of fresh air is continually circulating through the ship, preventing the accumulation of fumes of escaping hydrogen.

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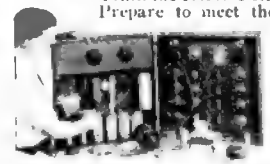

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How to Build a Record-Winning Model Plane

By Hi Sibley

(*Continued from page* 808)

Next set in the rear hook, made of about No. 8 music wire. This is inserted in a pinhole just forward of the stabilizer, and secured with ambroid.

For the propeller bearing a piece can be cut from stiff sheet brass, tin, or light galvanized iron. Before cutting, however, punch or drill a small hole for the prop shaft. Don't make it any larger than necessary for the shaft to turn freely.

The wing, fin and stabilizer are made from what is known as soft "sheet" balsa, or pieces of about 1/16 in. thickness. Here is where your skill comes in handy. These three pieces are sandpapered down to about 1/32 in., or thinner if you dare. To do the work, lay them flat on a smooth surface, such as a drawing board and with a piece of fairly coarse sandpaper wrapped over a flat stick sand them vigorously, but with caution. The edges should taper slightly. Apply ambroid to the tail slots and insert stabilizer and fin. The latter must be clipped diagonally at the bottom with a pair of sharp scissors to fit the diagonal slot prepared for it. They should be at right angles to one another and exactly in the plane of flight.

After the wing has been sanded to the required thinness round the tips with scissors and score lightly on the center line. The gentlest pressure will then break it sufficiently to form the dihedral angle. Better hold the edge of a ruler down on the center line when breaking. Now prepare a "cradle" as shown. Note that the bottom is beveled both ways to fit the dihedral. Apply ambroid and set in place, securing it with a steel pin and propping up the wing tips with blocks so they are 7/8 in. above the center. Let the ambroid harden for half an hour or more in all cases.

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For the propeller select a straight-grained piece of soft balsa ½ in. by ⅞ in. section and cut off a 7 in. length. Mark outlines of prop blank, as shown, (A) and whittle away the waste. GO EASY! Next bevel the blades with light cuts until they are about 3/16 in. thick as in (B) and (C). For greatest efficiency the blades should be curved, that is, front side convex and back concave. This is done by laying one blade flat on the edge of the workbench and working out the concave or hollow side by light cuts with a razor-sharp gouge, or curve 3/8 in. chisel (D). Finish with a piece of sandpaper fastened to a tapered block that is rounded at the bottom. A splendid job can be achieved in this manner.

Make the shaft hole with a steel pin, taking care that it is square with the blades and exactly in the center.

For the shaft, "S" hook and rear hook use about a No. 8 music wire, or whatever you have on hand fine enough and still strong enough to carry the load. All wire is held in place with ambroid. A thin brass or tin washer is ambroided to the prop hub.

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Is Space Curved?

By Donald H. Menzel, Ph. D.

(*Continued from page* 800)

curves. To say that space is curved, then, is simply short-hand for saying that the geometry adopted by Nature is not Euclidean, but of a more complex type. Many statements of Euclidean geometry are untrue, or perhaps only approximately true in the newer geometries. You have learned that three angles of a triangle sum up to 180°, two right angles. The proof of this theorem is made to depend upon that famous "parallel postulate" you just mentioned. Consequently it is not necessarily true, since the postulate is only an assumption.

P—If I measure three angles of a triangle, add them and find the sum equal to 180 degrees, is that not a proof Euclidean geometry is correct?

R—The older mathematicians sought to found their theories on logical grounds alone. They might, possibly, object to your method. But if you try it out on all sizes of triangles and find it to hold rigorously, I shall accept your proof. After all, the final test of any theory

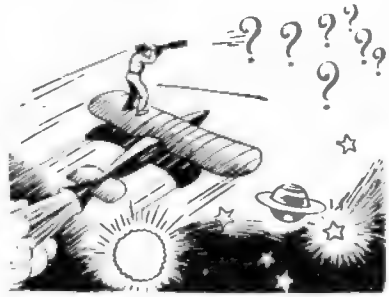

Fig. 7. What will one see if he gets to the very end of Einstein's limit of space and looks into the distance beyond?

should be its experimental check. Literally, the word, geometry, means to measure the earth, though the original definition appears to have been lost sight of by many mathematicians.

Here is a very accurate surveying instrument. When properly adjusted, it is capable of yielding an accuracy of much better than a second of arc. Suppose we spend the rest of the afternoon in an observational test. I am sure you will find it instructive. Let us measure three triangles, first a small field half a mile or so on a side, then a triangle with legs six or eight miles long, and finally one about twice as large.

* * * *

Intermission while the three friends complete the measurements. That evening we find them assembled to discuss the results.

* * * *

R—Now let us see how we stand. What were the figures on that first triangle?

P—(Referring to a slip of paper) The three angles were as follows:

44°	17′	20″
75°	12′	13″
60°	30′	27″
180°	00′	00″

They sum up to exactly 180 degrees. There now, isn't that good enough proof?

R: Yes, you seem to have proved that this first triangle fulfills the requirements

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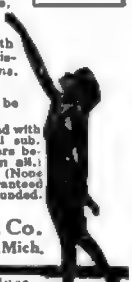

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of Euclidean geometry. But the next?

P: (reads)

39° 42′ 17″
61° 08′ 10″
79° 09′ 34″

This gives 180° 00′ 01″

What? There must be some mistake. No, I've added it correctly. That's queer, the angles sum up to one second more than they should. We must have measured them wrongly.

R—I'll reserve comment. What about the third and largest triangle?

P—(reads)

54° 18′ 48″
49° 22′ 36.5″
76° 18′ 38″

The sum is 180° 00′ 02.5″

That looks worse yet, two and a half seconds too large. What do you suppose can be the matter?

R—(smiling) The situation, you know is rather amusing. You must have forgotten your words of this afternoon. You were the one who suggested that we test the sum rule for triangles by actual measurement. Now that the measures don't fit with your expectations you are ready to throw them aside for a theory developed from a postulate that cannot be proved.

I.—I see the logic of your point of view, all right. As children we were, perhaps, too impressed with the apparent logic of Euclidean geometry. I suppose that is the reason we are so loath to accept anything else.

R—But that is no excuse for not keeping an open mind.

I.—But where's the catch? Surely Euclidean geometry isn't that far wrong?

R—A couple of thousand years ago, such measurements as we have made could not be explained away so easily. Then everyone thought that the earth was flat—a plane. We know it to be spherical. Hence instead of measuring the angles of a plane triangle, we have actually been surveying a spherical triangle, like this (Fig. 2). The greater our distances, the larger would be the discrepancy between our figures and your theory.

P—Then, for all practical purposes, the small triangle may be considered a plane.

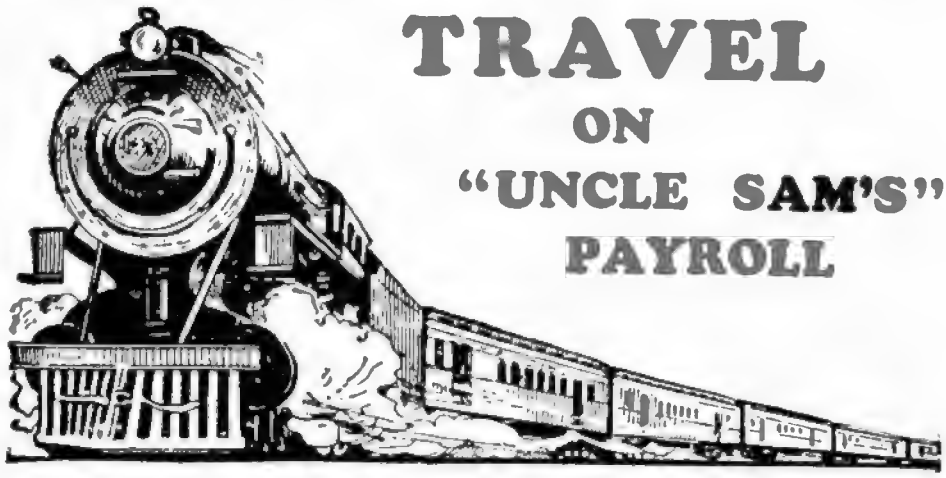
R: If by "practical" you refer to the particular surveying instrument we have used, the answer is yes. But if we had an instrument a thousand times more accurate—

I.—But in that event we could never find a perfectly plane figure?

R—Which would only go to prove that geometry is little more than an abstraction. It deals with planes and lines, which have no counterpart in nature. Sometime ago, I proved, I hope to your satisfaction, that there is no such thing as a straight line. By much the same type of argument I could prove that planes, also, are nonexistent.

The ancients thought the earth was flat. By such measurements as we have made today, only over still larger triangles, have the older beliefs been overthrown. But the change was a gradual one. The explanation which, to the ancients would have seemed most bizarre and artificial, seems quite natural to us.

P: I concede that nothing material can be perfectly plane, for matter is composed of atoms, tiny particles whose shape is by no means regular. It would be as impossible to build a flat surface of atoms as to make one out of a stack of cannon balls, although, since the atoms are so much smaller, the cracks between them will be invisible to the eye; nevertheless they are there. (Fig. 3) But our instruments seem to have proved only that the earth is round—rather than that space,



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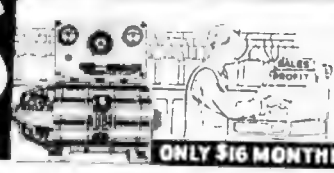

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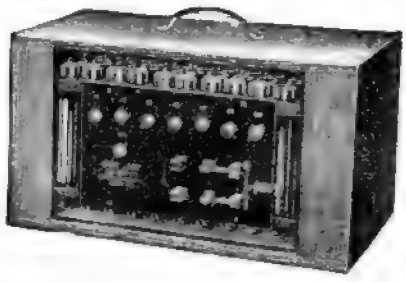

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itself, is curved. Surely there are much flatter surfaces in nature than on earth's!

Suppose we build our triangle out of light rays. What then? Here is no question of irregularity.

R—It is true that our measurements of this afternoon did not prove that space is curved. But they did indicate that Euclidean Geometry cannot be applied to curved surfaces. I am not sure that your last suggestion helps. Light is made up of waves. An actual beam of light would look something like this. (Fig. 4) The arrow through it indicates the general path of the beam in space. It is that which you wish to call a straight line.

You'll agree with me, I'm sure, that we've met a very practical difficulty. We need a measuring rod to explore space with and not a single one begins to fit the specifications laid down by Euclid.

I am most anxious that you allow me to build triangles out of light rays, since that is the only means I have of surveying the stars. But, if you recall, the path of a light ray is not a straight line in the sense you probably imply. A ray follows the path of least resistance, called a geodesic, which is about as close as we can possibly come to the absolutely straight line. In that case geometry becomes a study of the path of light rays in space, which is, of course a perfectly definite

Fig. 10. Did you ever try to fit a flat map to a globe?

and concrete problem. When we point our telescope at some distant celestial object, it is natural for us to think of it as being in the direction it appears to be, as at A (Fig. 5), when in actuality, it is at B, with the light traveling in a long curve.

P—Then should we not measure along the straight path, OCB? (Eye=O).

R—You might like to—but our measuring rod, the light ray, refuses to conform to your path. Remember that its geometry limits our problem.

L—Then should we not get a better measuring rod?

R—I am perfectly willing—but show me a better one? Did we not agree that light is the best we can find? Trying to make our rods behave according to Euclidean standards is like squeezing a number eight foot into a number six shoe; it may possibly be accomplished, but the game isn't worth the candle. Our measurements would be meaningless if we did, because something would be distorted by the operation. What is there about the straight line that is worth keeping, especially since it has no existence outside of our own minds? Euclidean geometry describes the world as some people think it ought to be. Relativity takes the world as it is. The ancients believed that the circle and straight line were sacred. Hence the planets ought to move in circles. They don't. There is a strong division between *ought* and *reality*.

L—Why should light rays travel in a curve?

R—I ask you why should they travel in a straight line?

L—It seems much more reasonable, I think.

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R—When you see a fish in the water, it is not in the direction you are looking, but below it. The light ray is bent on leaving the water. (Fig. 6.)

L—I still have a question. If space is finite, and every straight line becomes a circle, what lies beyond the largest circle we can possibly draw? (Fig. 7)

R—That question always comes up, and has puzzled many people. When Columbus maintained that the earth was round, his opponents sought to disprove his statements by asking if men walked on their heads at the antipodes. Always the question of the opposite side of the universe! The ancients supposed that the flat earth was bounded by high mountains.

When you talk about the "end of the universe" you presuppose some sort of boundary there, like the mountain-fringed earth. You have the idea that the biggest circle actually bounds something. That when you stand upon it you will be able to look out into the beyond, much as a man standing upon the top of one of the mountains supposed to encircle the flat earth, might have done. (Fig. 8).

But the earth is not flat. There is a definite limit to the size of the greatest circle that can be drawn upon it. But when you stand on one of these circles, the equator for example, will your next step precipitate you into the "beyond"? (Fig. 9.) There is no gaping void.

The same is true for the world, except that the curvature is three instead of two dimensional. In this universe, as upon the earth, there is a circle of maximum size—but it does not bound the universe any more than the equator bounds the earth's surface. Like the earth, the universe is *finite* and *unbounded!* *

L—I find it difficult to picture such a universe. When you get away out there on the other side of the circle, what will it be like?

R—I warn you. Do not try to visualize it for it cannot be done. Your difficulty, however, is quite obvious, from the nature of your question. It is not an inability to comprehend the regions of space immediately surrounding you. Your mind staggers only when you insist on trying to visualize both the neighboring and distant regions simultaneously.

L—Just how does the question arise?

R—The space you are familiar with—that bordering the earth—is so very nearly Euclidean (flat) that your mind refuses to work any other way.

You know, of course, that it is impossible to map a curved surface on a flat sheet of paper, without distortion. Lets try to paste this flat map to that globe. Here we are at New York; paste that point on first. It fits pretty well, doesn't it, in the neighborhood of New York? But look! The farther we go from where we are the more I have to fold it and pucker my Euclidean map in order to make it curve round the globe.

* Figure 8 bears the same relation to the question raised by (7) as figure (9) does to the true nature of the universe. Ed.

Writing and Stationery Cabinet

(*Continued from page* 815)

makes for a stronger job than just halving them in, the divisions being fixed in V grooves as at Fig. 6.

The ornamentation on the cabinet consists of rows of ¾-inch turned beading on the edges of the sides and top, and a fret-sawn (plywood) ornament similar to that shown at Fig. 7 on the top of the back, with a 1¼-inch turned button mounted upon it.

When I Learned Millions of Men Suffer with This Gland Disorder

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For some time I had been consulting a scientist with regard to certain manufacturing formulas. One day, after such a discussion in my office, this man said, "You have many men working for you. Have you ever noticed how many men seem to suddenly grow old, go all to pieces in less than a year's time when they reach a certain middle age?" I told him I had noticed this in many cases. Further I said I was very much interested as I was nearing 40 myself.

"Prostate trouble is the answer," he said.

"That hardly seems possible," I replied. "Why, I know of very few men who ever had that disorder."

"Yes, most men are like you—they know little about the prostate gland—yet highest medical authorities definitely say that nearly 7 men out of every 10 have prostate disorder after a certain age. Literally millions of men have prostate trouble without knowing it. Some confuse their trouble with kidney or bladder derangement. Others think that they are aging prematurely—that pains in feet, legs, back, and head are merely the result of advancing years and so do nothing about it."

Then he told me of his discovery, a simple, easy way to stimulate the prostate gland—and how he had placed it in the hands of physicians and afflicted men for conclusive trial. The results had been even more satisfactory than expected, in some cases almost miraculous.

He ended by saying, "Money and business experience is necessary to bring this discovery to the millions of men who need it, at a cost everyone can afford. You are just the man."

My decision was made within a few days. Today I see that decision rewarded a thousand times over. Thousands of letters come to me from men telling of relief from most distressing conditions. Some tell how they have been saved from the necessity of the surgeon's knife in a painful gland operation. Others tell of relief after all other methods have failed. Many say they feel 20 years younger—relieved from the torturous and painful conditions that often make life a burden for men of mature years.

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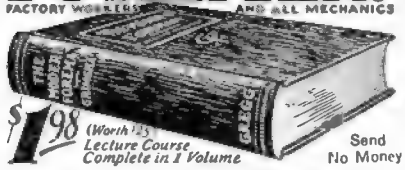

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How to Prepare Dyes and Pigments

(*Continued from page* 810)

cooling, the sodium salt will crystallize in the form of brownish red needles. Sometimes crystallization may require a long time.

To prepare ammonium eosin place some eosin in a small evaporating dish and cover with strong ammonia. After five or six hours the eosin will have been converted into ammonium eosin. The dye can be filtered off and dried.

In the process of dying the dye is brought into solution with water and the textile is passed through it. Many dyes will unite directly with the fibre of the cloth, but there are also a large number which are dyed on the fabrics by means of metallic mordants. A mordant is a salt which will combine with both the dye and the cloth. The cloth to be dyed is passed through the mordant, which latter combines with it and then through the dye solution, the dye in turn uniting with the mordant and forming a fast color.

Kanarin, a yellow dye, can be made by the process of electrolysis. The apparatus is arranged as the diagram shows and connected to a source of direct current. The solution for the apparatus is made by dissolving some potassium sulphocyanide in water. As the current passes, yellow clouds of the dye are formed and settle to the bottom of the container. After a short time the dye can be filtered off and dried.

Tricks With a Phonograph

(*Continued from page* 809)

reverse the direction of his foot, then immediately does his hand cease to turn the record.

Now for Fig. 4—little Junior is playing tricks on Grandpa. Junior holds the cover of a bread pan—a reflector of sound—and he can thus project a beam of sound in any direction that he swings the cover.

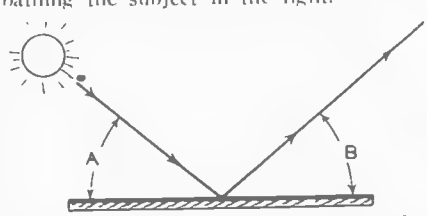
Psst—Fig. 5 is the "bug." The fellow kneeling and blowing rings has offered to demonstrate that there are always "acoustic forces" responsible for the propagation of sound. These forces—so goes the argument—can exert an interference-torque upon bodies resonant to the vibrations of sound. Hence it must follow that a smoke ring—a most deucedly peculiar vortex—will rotate ninety degrees upon its axis if blown into the path taken by a sound wave.

Reflectors for Amateur Movie Makers

(*Continued from page* 815)

In a pinch the white-enamelled top can be taken from the kitchen table and used as a reflector.

A hand spot lamp, consisting of a shade with a 200 or 250-watt lamp, also forms a good source of auxiliary light. In using a light of this type, the lamp should be moved about the subject the whole time the exposure is being made, flooding or bathing the subject in the light.



The angle A equals the angle B and complete reflection of the source of light is only had when these angles are equal.

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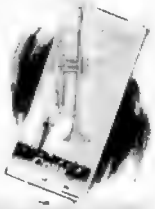

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Inexpensive Home-Movie Sets

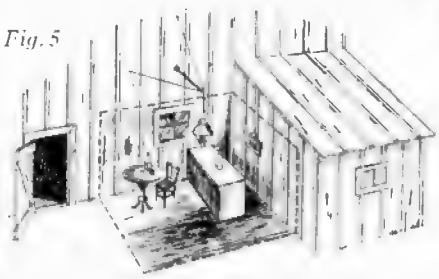
By Don Bennett

(*Continued from page* 806)

big "drammers" and "spectacles." They have been the backbone of the motion picture industry because of their universal appeal. What should be more fitting than that the amateur club produce a Western, especially when horses and open country are available. Overacting or underacting are not serious in a Western as everyone expects the villain to swagger around and the hero to be stiff. Pick your best swaggerer for the "villin" and the stiffest boy for the hero. Of course you must be diplomatic in picking the prettiest girl for the heroine, but she should have long blond curls to be a true Hollywooden type. She needn't act. All she needs is to look pretty and scared, by turns.

With the boy's (small and grown-up) love for O. Henry, why not pick on one of his tales for your Western. And don't be afraid to pick one with interiors. Have you an old shed or barn that has an ell? That's your western interior. Take a look at Figure 5. There is a typical barn with the last letter dropped as far as our movie camera is concerned. It has been transformed into a western bar. The cowshed becomes the back wall of the bar, bearing such representative mottoes as "Don't shoot the bartender," "In God we trust" and others of that day and time. The bar is made of old lumber, the top painted with yellow kalsomine to represent a much-scrubbed board. The sides can be stained dark or covered with dark crêpe paper. The window should be dirty with a few fingermarks, as if it had been treated for transparency on occasion. A round table in front of the bar with a kitchen chair or

Fig. 5



A "Western" saloon scene built against an ordinary barn.

two, a tall, small-necked bottle (borrow one from your local museum because they're as extinct as the dodo), several glasses, some poker chips, a pack of cards and a few water spots dress the table. Sawdust spread over the dirt and smoothed out level before being tracked up with feet. The sawdust thin near the bar, a small ridge piled up about a foot and a half away from it. An old hanging oil lamp is suspended from the ceiling (a stick nailed to the side of the barn above camera range with a rope or chain supporting the lamp.

For "reverse angle" shots, that is, shots taken from the bar looking towards an imaginary door we use the door further down the barn, or even on the other side. Spread some sawdust near it, thinning it out in a V shape with the apex away from the door sill. When shooting an exit or entrance, give the effect that the door is opposite the bar by having some one (the bartender) look up when an entrance is due. Let your character walk on and later on shoot a shot from square on to the door with the

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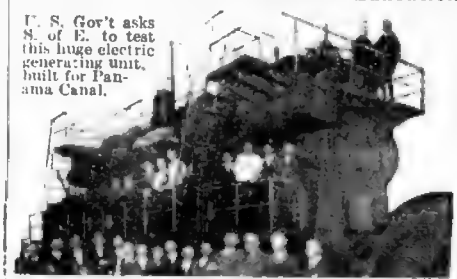

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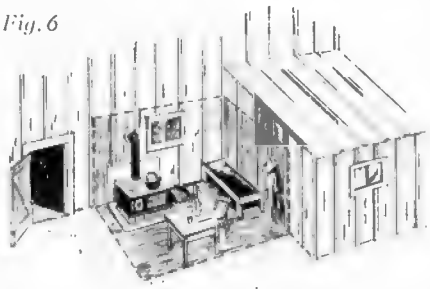
(Continued from page 857)

character walking through the door towards the camera.

The same location, with a slightly different treatment is used as the rustlers' cabin. The bar is removed, and in its place we have a bunk made of rough timbers and holding a mattress stuffed with leaves. A few dark blankets rumpled up on the bunk and a wad of cloths for a

Fig. 6



A "miner's kitchen" setting arranged cheaply with the aid of an old barn.

pillow complete the dressing of the corner. (Fig. 6) A rough table with a cowboy's candlestick (a liquor bottle with a candle in the neck) and a few dirty dishes occupy the center of the stage. A chair or two (different from the two in the saloon set) an old wood-burning cookstove and a pile of wood for it are against the wall. A light piece of cloth over the window inside the barn will serve for daytime shots, removing the cloth for "night" scenes. If the door happens to be located as shown in the drawing, use it as the door of the cabin, but never show it open to the camera. When an entrance is required, place the camera where the opening door will cover any "outside" shots of the inside of the barn, except for the night scenes when this care is not necessary. Drive a few nails around the walls and hang some old clothes or riding gear on them.

A little ingenuity in following out these suggestions, as far as local conditions will permit, is sure to result in lots of fun both in making the films and in showing them.*

Every organized club should have as a club project the production of a film. And as a word of caution, don't try comedies. They are the hardest of all to make. Stick to drama and westerns, they are more in the amateurs' line and are easier to produce.

Contest Announcement

**(Editor's Note: If you have any difficulty in applying these suggestions send several photographs of your location from various angles with an outline of what is wanted. The Editor will gladly advise you, in return for a photograph of the dressed set, how best to convert the "natural" into what you want. And in addition to that he will give a copy of an interesting one hundred foot, sixteen millimeter library film to the club or individual that sends a photograph of the unique application of this article. All photographs must reach the Editorial Offices of* SCIENCE AND INVENTION *not later than midnight, January 31, 1930. The prize, or prizes will be awarded as soon after that date as possible. The right is reserved to publish any photographs entered in the contest. Write name and address on back of each photograph submitted. None will be returned unless postage is enclosed. The judges will be the Editors of* SCIENCE AND INVENTION *and their decisions will be final.)*

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The Savings Bank—Living Insurance

By Alfred M. Caddell, *Financial Editor*

WE have been hearing a lot lately about stocks and bonds as investments, but little attention has been given by the press to America's oldest standby—the savings bank.

Last year approximately $40,000,000,000 was on deposit in the savings banks of the nation, earning from 3½ per cent compounded monthly to 5 per cent if left over a period of time, and with little or no risk to investors. True, these savings banks reinvest their depositors' accumulations in sound securities, such as first mortgages on business and home properties, government bonds and the like. In a sense, therefore, the savings bank is the first real investment trust, and the depositor's pass-book is his share of stock—good for its face value plus accrued interest or dividends.

In bygone days, the long lines of depositors at the savings banks on Saturday nights constituted one of the outstanding features of the investment world. Owing the bank for one's own personal account was a wonderful form of debt to get into. But, nowadays, the long lines are giving way to Uncle Sam's mail-carriers. Deposits by mail constitute a large and ever-increasing way of paying the bank something for yourself.

Progressive savings banks all over the country have gone in for save-by-mail campaigns. The Franklin Society for Home-Building and Savings, in New York City, is an outstanding example of save-by-mail institution. Their advertisements have brought them depositors from all over the country, not that they are desirous of taking customers from other banks, but rather to interest the man or woman, boy or girl, who otherwise would fritter away his hard-earned cash into meaningless nothings. The Emigrant Industrial Savings Bank, another New York City institution, reputed to be the largest savings bank in America, is another institution which has added the names of many depositors to its books through the facilities offered by Uncle Sam. Also the National City Bank (New York), which has inaugurated a statement plan as a means of reminding depositors that they owe the bank something for themselves every month. They mail out a statement about the 25th of every month, notifying depositors that another payment to their own account is due. This statement serves as a deposit slip and upon receipt the depositor simply fills in the amount he wishes to deposit, encloses it with his remittance in an envelope and sends it merrily on its way. So that no error in address shall take place, these banks provide self-addressed envelopes.

A large number of savings banks now pay interest on savings from the day received to the day of withdrawal. Modern business equipment, interest tables and the like make it possible for receiving tellers to make an entry, post the bank's ledger and bring an account up-to-the-minute all in one operation. This makes it possible to effect short-cuts in bookkeeping, guarantee precision and speed and for one man to handle thousands of accounts in one day.

As an example of growth in the use of the save-by-mail plan, the mailing department of The Franklin Society handled 100,151 pieces of incoming mail in the twelve months ending June 30, 1927. The following twelve months showed an increase to 128,171, while in the last twelve months ending June 30, 1929 the total

(*Continued on page* 861)

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The Commander

Shoal Waters

Wherein Young Channing Meets the Toughest Trio North of Rio—

Old Pawlins

A Desperate Gang of Bootleggers Dare Everything to Run Uncle Sam's New Coast Guard Blockade

THE beam of the searchlight moved in a wide circle as Ensign Channing followed its course with his binoculars. The Coast Guard cutter was running parallel to the shore and several miles out. They had run south from Cape Fear River to Snake River Inlet and were heading back to the station.

Old Pawlins was standing beside the ensign.

"The sea is running high tonight. Good night for the rum runners to try to make a landing," he said.

"His gun, thank God, was still dry"

Bart Channing nodded. He could feel the boat riding the huge swells as he watched the white caps, iridescent in the stream of light.

"It was on a night like this that Lieutenant Hogan made his capture," said Fleming.

Always Lieutenant Hogan. Channing thought. He heard of nothing but that capture since he joined the Coast Guard Station. Hogan himself seemed to feel superior because he was an Annapolis graduate, and more than once he had spoken in slighting terms of the Coast Guard Academy from which Bart Channing had recently been graduated.

"Look! To the starboard!" shouted Carey from his position beside the electrician on top the small cabin.

"She's a rum runner, and one of them fast ones," Pawlins exclaimed, looking at Ensign Channing

Channing cursed himself as he picked the speeding rum boat up through his glasses. While he had been thinking of Hogan these enlisted men had located the boat with their naked eyes. He removed his glasses and figured rapidly.

"They're heading for Dead Man's Inlet," Fleming cried, waiting nervously for commands.

Dead Man's Inlet was one of the numerous indentures which dotted the Carolina coast. The water at its entrance was rough and its mouth was jammed with islands. Several narrow, winding creeks flowed out of it through the heavy brush of the swamp. Once lost in that inlet, the rum boat would be safe.

Channing

"Stand by to fire," Channing ordered.

So begins but one of the great rip-roaring stories of he-man adventure to be found in the NEW BRIEF STORIES for January. Get a copy today from your nearest news-stand and follow Channing and his shipmates through the most bewildering experiences ever to happen to a Coast Guard crew.

"Shoal Waters" is only one of a dozen great adventure stories which appear every month in the fascinating NEW BRIEF STORIES. Read "SOS'ed to Victory," a story of the Great War in which the enemy tries to pull a fast one; "Four-footed Fury," wherein a famed Spanish matador is outdone by an American cowboy in a thrilling duel of the bull-ring; "The Ace of Death," a fiery tale of South American intrigue, with a fabulous gold mine as the winner's stake; "There's Gold Across the Seas," an unusual tale of an old newspaper reporter who sets out to obtain the strange fortune willed to him by his former major in France; "Red Diamonds," in which an African missionary stumbles upon King Solomon's fabulous wealth and the fight of his life; and "Flying Gold," involving a thrilling fight in the air for a fortune.

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"He shoved her hard aport, and in a split second the boat was half filled with water"

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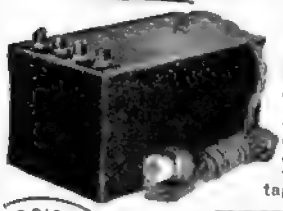

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(Continued from page 859)

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Questions and Answers

Conducted by Alfred M. Caddell

Financial Editor

Question—What is the outlook for Radio Corporation of America? I own ten shares bought at 80. E. L. B., Ridgewood, N. J.

Answer—For the long pull there is hardly any question but what Radio Corporation will prove to be a good investment. This corporation is the holder of basic radio patents which are used largely by other manufacturers. It is also affiliated with other promising enterprises in the amusement world, as well as being one of the world's leaders in radio-telegraph communication. Long pull accumulation has been proceeding in Radio in the belief that the stock has inviting potentialities over the next few years, but the recent high prices have discounted the future several years.

Question—I am a business woman with two children to support. Have $5,750 in the savings bank which I would like to invest. What do you suggest? Mrs. C. R. B., Lima, Ohio.

Answer—If you now have a steady income, I would suggest investing $5,000 in good stocks and bonds, leaving $750 for emergency purposes. For your purposes, ten shares of Utah Power & Light $7 preferred stock, ten shares American Water Works & Electric first preferred, ten American Brown Boveri preferred, American Steel and Foundry preferred, Pacific Tel. & Tel. preferred, or any multiple that you may desire. This will provide diversification with safety and yield you 7 per cent on your capital. For bonds, New York Title & Mortgage, $5,000 5½s, Lawyers Mortgage, 5½s, S. W. Straus first mortgage 6s and National Mortgage 5½s offer good diversification with nominal income.

Question—I have been offered 100 shares of Ford Motor, Ltd., at 20. Do you consider this a good buy? P. L. A., Houston, Texas.

Answer—Ford Motor, Ltd., an English company, offers a good speculation. The company is an extension of the Ford Motor Co. and should become a dividend-earner. But why pay 20 for this stock when it can be purchased in the open market for less? Stock recently sold as low as 10⅞ and at this writing is about 14.

Information on securities will be furnished readers of "Science and Invention" free of charge by mail and through these columns. A 2-cent stamped, self-addressed envelope should be included in your letter. Address The Financial Editor, Science and Invention, 381 Fourth Ave., New York City.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. The dealer will then be in a position to supply copies to you regularly every month. If you are interested in reserving your copy every month, do not fail to do this. It costs you nothing to do so.

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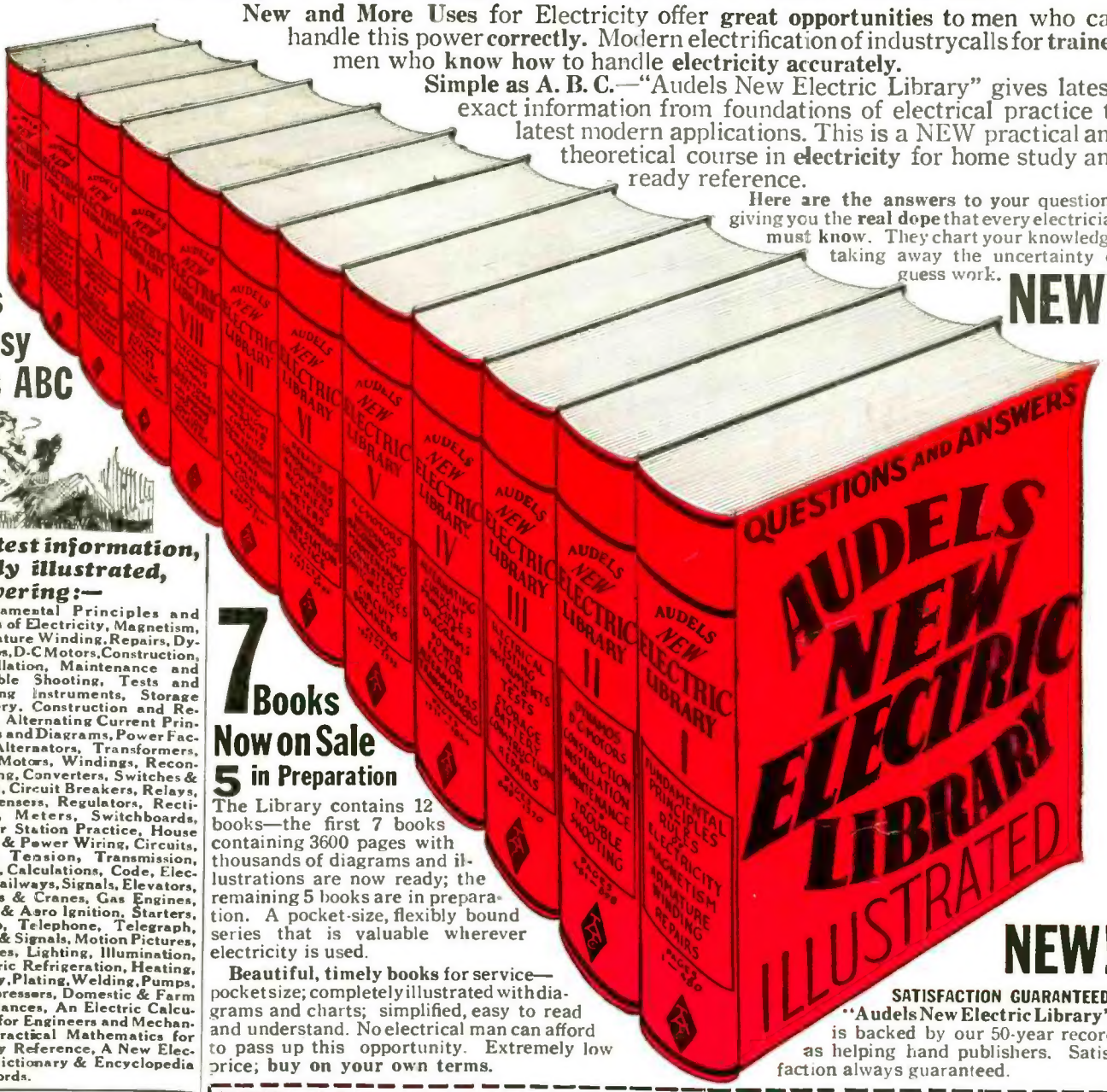

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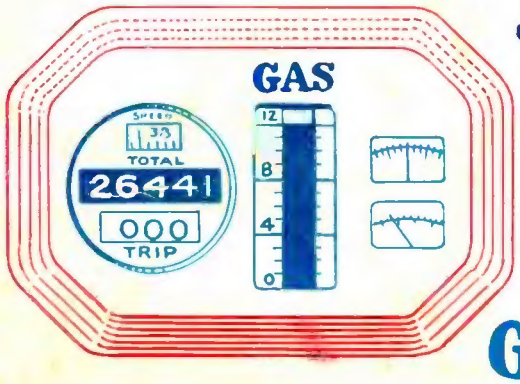

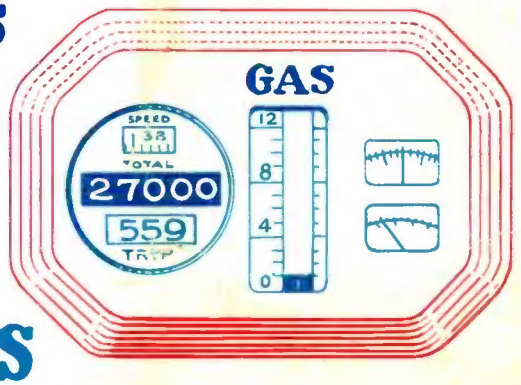

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Car owners all over the world are saving money every day with the Whirlwind, besides having better operating motors. Think what this means on your own car. Figure up your savings—enough for a radio—a bank account—added pleasures. Why let the Oil Companies profit by your waste. Find out about this amazing little device that will pay for itself every few weeks in gas saving alone.

FITS ALL CARS

In just a few minutes the Whirlwind can be installed on any make of car, truck, or tractor. It's actually less work than changing your oil, or putting water in the battery. No drilling, tapping or changes of any kind necessary. It is guaranteed to work perfectly on any make of car, truck or tractor, large or small, new model or old model. The more you drive the more you will save.

SALESMEN AND DISTRIBUTORS WANTED

Free Sample and $100.00 a Week Offer

Whirlwind men are making big profits supplying this fast-selling device that car owners cannot afford to be without. Good territory is still open. Free sample offer and full particulars sent on request. Just check the coupon.

WHIRLWIND MANUFACTURING CO.
999-70-A Third Street Milwaukee, Wisc.

GUARANTEE

No matter what kind of a car you have—no matter how big a gas eater it is—the Whirlwind will save you money. We absolutely guarantee that the Whirlwind will more than save its cost in gasoline alone within thirty days, or the trial will cost you nothing. We invite you to test it at our risk and expense. You are to be the sole judge.

FREE TRIAL COUPON

WHIRLWIND MANUFACTURING CO.
999-70-A Third Street, Milwaukee, Wisc.

Gentlemen: You may send me full particulars of your Whirlwind Carbureting device and free trial offer. This does not obligate me in any way whatever.

Name .....

Address .....

City .....

County ..... State .....

☐ Check here if you are interested in full or part time salesmen position.